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For: **ORGANIC EL DEVICE AND METHOD FOR MANUFACTURING THE SAME**

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VERIFICATION OF ENGLISH TRANSLATION

Sir:

I, Woo Hyun Hwang, am fluent in both language of Korean and English. I translated the Korean Patent Application No. 2000-76528 into English and hereby certify that the English translation attached hereto is a correct and accurate translation of Korean Patent Application No. 2000-76528

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[ABSTRACT]

[Abstract of the Disclosure]

An organic EL device includes a thin film transistor (TFT) array substrate including a first insulating substrate, a TFT formed on the first insulating substrate and a capacitor; and an organic EL substrate including a second insulating substrate, and a transparent electrode, an organic EL layer and a metal electrode, which are sequentially stacked on the second insulating substrate; wherein the TFT is electrically connected to the metal electrode.

[Representative Drawing]

FIG. 18

[SPECIFICATION]

[Title of invention]

ORGANIC EL DEVICE AND METHOD OF MANUFACTURING THE SAME

[Brief Description of the Drawings]

For a more complete understanding of the present invention and the advantages thereof, reference is now made to the following descriptions taken in conjunction with the accompanying drawings, in which like reference numerals denote like parts, and in which:

Figs. 1 and 2 are processing views a process of manufacturing a first semiconductor layer of a first TFT and a second semiconductor layer of a second TFT on a driving circuit substrate according to a first preferred embodiment of the present invention;

Figs. 3 and 4 are processing views a process of manufacturing a gate

insulting on a upper of the first and second semiconductor layers according to a first preferred embodiment of the present invention;

Figs. 5 and 6 are processing views a process of manufacturing first electrodes of a first, a second gates and capacitance in the state that a gate metal layer is formed on the upper of the gate insulating layer according to a first preferred embodiment of the present invention;

Figs. 7 and 8 are processing views a process of manufacturing source/drain insulating layers according to a first preferred embodiment of the present invention;

Figs. 9 and 10 are processing views a process of manufacturing a contact hole according to a first preferred embodiment of the present invention;

Figs. 11 and 12 are processing views a process of manufacturing a source electrode, a drain electrode and a second electrode on the upper of the source/drain insulating layers according to a first preferred embodiment of the present invention;

Figs. 13 and 14 are processing views a process of manufacturing a planarization layer according to a first preferred embodiment of the present invention;

Figs. 15 and 16 are processing views a process of manufacturing an interface pad after forming a contact hole a planarization corresponding to a drain electrode fo the second TFT according to a first preferred embodiment of the present invention;

Fig. 17 is a cross-sectional view illustrating an organic EL substrate according to the first preferred embodiment of the present invention;

Fig. 18 is a cross-sectional view illustrating an organic EL device according to the first preferred embodiment of the present invention;

Fig. 19 is a circuit diagram illustrating an equivalent circuit of one pixel of the organic EL device according to the preferred embodiments of the present invention;

Fig. 20 is a cross-sectional view illustrating a process of assembling the organic EL device according to the first preferred embodiment of the present invention;

Fig. 21 is a perspective view illustrating a TFT array substrate according to a second preferred embodiment of the present invention;

Figs. 22 to 25 are cross-sectional views illustrating a process of manufacturing a organic EL substrate according to the second preferred embodiment of the present invention;

Figs. 26 and 27 are cross-sectional views illustrating a process of assembling the TFT array substrate and the organic EL substrate according to the second preferred embodiment of the present invention;

Figs. 28 to 30 are cross-sectional views illustrating a process of manufacturing a organic EL substrate according to a third preferred embodiment of the present invention; and

Figs. 31 and 32 are cross-sectional views illustrating a process of assembling the TFT array substrate and the organic EL substrate according to the third preferred embodiment of the present invention.

[Detailed Description of the invention]

[Object of the Invention]

[Technical field of the invention and Related Art prior to the Invention]

The present invention relates to an organic EL device and a method of manufacturing the same, and more particularly, to active matrix organic light emitting diodes (AM-OLED).

Recently, in organic EL devices, active matrix organic light emitting diodes (AM-OLED) that can individually control respective pixels are wide in use. Each of the pixels typically includes first and second thin film transistor (TFT) formed on a transparent substrate, a transparent lower electrode electrically connected to a storage capacitor and a drain electrode of the second TFT, an organic EL region formed on the lower electrode to emit light having a predetermined wavelength, and an opaque upper electrode formed of a material such as aluminum over the whole surface of the transparent substrate.

At this point, let us define the AM-OLED which light is emitted through a back surface of the organic EL region due to the opaque upper electrode as a "back surface emitting AM-OLED", a surface through which light emits as a "back surface", and a surface through which light does not emits as a "front surface".

Meanwhile, in the back surface emitting AM-OLED, of the pixel area, most is occupied by the first and second TFT and the storage capacitor, and therefore, light emitted from just about 20% of total pixel area is directed toward observers. That is, the back surface emitting AM-OLED has an aperture ratio of about 20 %. Therefore, it is difficult to implement a high luminance. In other words, in order to increase brightness in a low aperture ratio, a current amount

should be increased. As a result, power consumption increases, and this is unsuitable for portable display devices.

In order to overcome the problems, the AM-OLED should have a front surface emitting structure which light is emitted through the front surface. For the front surface emitting AM-OLED, the lower electrode should be made of an opaque material, and the upper electrode should be made of a transparent material.

However, if the transparent upper electrode is formed on the organic EL region, since the transparent upper electrode is deposited at a relatively high temperature, the organic EL region may be damaged. Therefore, it is very difficult to embody the front surface emitting AM-OLED.

U.S. Patent No. 6,046,543 to Bulovic, et al., entitled "*high reliability, high efficiency, integratable organic light emitting devices and methods of producing same*", describes a method of forming a transparent cathode electrode in order to implement the front surface emitting AM-OLED. U.S. Patent No. 5,981,306 to Burrows, et al., entitled "*method for depositing indium tin oxide layers in organic light emitting devices*", describes a method of forming indium tin oxide (ITO) at a very low depositing rate in order to implement the front surface emitting AM-OLED. U.S. Patent No. 5,739,545 to Guha, et al., entitled "*organic light emitting diodes having transparent cathode structures*", describes the front surface emitting AM-OLED implemented using a transparent cathode electrode.

However, such methods are not easy to implement, and a processing time is lengthy. In addition, it is difficult to control characteristics. Besides, in the conventional AM-OLED, as described above, the metal can is used to protect

the organic EL region from oxygen and moisture, and therefore, a weight and a volume of the AM-OLED becomes increased as a whole.

[Technical Goal of the Invention]

To overcome the problems described above, preferred embodiments of the present invention provide an organic EL device having a front surface emitting AM-OLED which has a stacked structure, sequentially stacked a trasparent lower electrode on a substrate, an organic emitting layer and an opaque upper electrode.

It is another object of the present invention to provide an organic EL device having a high aperture ratio, a high brightness, and a low power consumption.

It is another object of the present invention to provide an organic EL device having a high reliability and a lightweight.

[Structure and Operation of the invention]

In order to achieve the above object, the preferred embodiments of the present invention provide an organic EL device, comprising: a driving circuit substrate which includes a first substrate; a first display power supplying means formed on a predetermined part of the first substrate and supplying a first display power to an outside; and a power supplying pad connected to an output terminal of the first display power supplying means and receiving the first display power; and a display substrate which includes a second substrate; a first transparent electrode formed on the second substrate and receiving a

second display power; an organic emitting layer formed on an upper part of the first electrode and for generating a light having a predetermined wavelength; and a second electrode fromed on an upper part of the organic emitting layer and electrically connected to the power supplying pad.

The preferred embodiment of the present invention further provides a method of manufacturing an organic EL device, comprising: forming a first display power supplying means for supplying a first display power to an outside on a first substrate; manufacturing a driving circuit substrate by extending an output terminal of the first display power supplying means to an upper part of the insulating material to form a power supplying pad in the state of insulating the first display power supplying means by an insulating material; manufacturing a display substrate by sequentially forming a first electrode on a transparent second electrode, the organic emitting layer on the first electrode and a second electrode onthe organic emitting layer; aligning the driving circuit substrate and the display substrate on a vacuum circumstance to adhere closely each other by the second electrode of the display substrate and the power supplying pad of the driving circuit substrate; and sealing the first substrate and the second substrate by coating edges of the first substrate and the second substrate with a bonding agent.

Also, The other preferred embodiment of the present invention further provides a method of manufacturing an organic EL device, comprising: forming a first display power supplying means for supplying a first display power to an outside on a first substrate; manufacturing a driving circuit substrate by extending an output terminal of the first display power supplying means to an

upper part of the insulating material to form a power supplying pad in the state of insulating the first display power supplying means by an insulating material and forming a conductive bump pad on an upper part of the power supplying pad; manufacturing a display substrate by sequentially forming a first electrode on a transparent second electrode, the organic emitting layer on the first electrode and a second electrode ont he organic emitting layer, and forming a protection film in order to only expose the second electrode; forming a conductive bonding agent to one of one side of the protection film and one side of the conductive bump pad; and transforming the conductive bonding agent in order to generate an electron flow between the conductive bump pad and the second electrode.

Also, The other preferred embodiment of the present invention further provides a method of manufacturing an organic EL device, comprising: forming a first display power supplying means for supplying a first display power to an outside on a first substrate; manufacturing a driving circuit substrate by extending an output terminal of the first display power supplying means to an upper part of the insulating material to form a power supplying pad in the state of insulating the first display power supplying means by an insulating material and forming a conductive bump pad on an upper part of the power supplying pad; sequentially forming a first electrode on a transparent second electrode, a polymer bump protruded on an opposite side to the conductive bump pad on the first electrode, an organic emitting layer on the part from an upper part of the polyme bump to a predetermined position of the first electrode, and a second electrode on the organic emitting layer; forming a conductive bonding

agent to one of one side of the protection film and one side of the conductive bump pad; and transforming the conductive bonding agent in order to generate an electron flow between the conductive bump pad and the second electrode.

Reference will now be made in detail to preferred embodiments of the present invention, example of which is illustrated in the accompanying drawings.

A configuration of an organic EL device according to the preferred embodiment of the present invention will be explained through a process of manufacturing the organic EL device. In order to manufacture the organic EL device, a TFT array substrate (see 500 in Fig. 15) supplying a display power to the organic EL region and an organic EL substrate (see 900 in Fig. 17) including an organic EL region are respectively manufactured and then are assembled.

First, a process of manufacturing the TFT array substrate 500 according to a first preferred embodiment of the present invention is explained with reference to Figs. 1 to 16 and 19, and a process of manufacturing the organic EL substrate 900 according to the first preferred embodiment of the present invention is explained with reference to Fig. 17. Thereafter, a process of assembling the TFT array substrate and the organic EL substrate according to the first preferred embodiment of the present invention is explained with reference to Figs. 18 and 20.

In order to form one unit pixel on the TFT array substrate 500, as shown in Fig. 19, on a base substrate (see 400 in Fig. 1), two thin film transistors (TFTs) 100 and 200, a storage capacitor 300, gate lines 430 supplying a bias voltage to turn on the TFTs, data lines 450 to which an image signal encoded from an image signal processing apparatus (*e.g.,* VGA card), and common

power lines 460 are formed.

First, in order to manufacture the first and second TFTs 100 and 200, as shown in Figs. 1 and 2, a buffer layer 410 is formed on the whole surface of the base substrate or first insulating substrate 400 in a predetermined thickness.

The buffer layer 410 serves to prevent ions that may affect the first and second TFTs 100 and 200, and the storage capacitor 300 that will be formed in a subsequent process from being diffused from the base substrate 400 into the first and second TFTs 100 and 200, and the storage capacitor 300.

For example, when the base substrate 400 is made of glass, the buffer layer 410 shields ions such as Na^+ and K^+ from being diffused from the base substrate 400 into the first and second TFTs 100 and 200, and the storage capacitor 300.

An amorphous silicon layer is deposited on the buffer layer 410. Even though not shown, the amorphous silicon layer is subjected to an annealing process, for example, a laser annealing, to form a polycrystalline silicon layer. The reason to form the polycrystalline silicon layer is that the polycrystalline silicon layer has superior electron mobility to the amorphous silicon layer. Instead of depositing and annealing the amorphous silicon layer to form the polycrystalline silicon layer, the polycrystalline silicon layer may be deposited directly on the buffer layer 410 through, for example, a chemical vapor deposition (CVD) technique. Therefore, the polycrystalline silicon layer is patterned into first and second semiconductor layers 110 and 210 in the form of an island.

For more detail, a photoresist is coated on the polycrystalline silicon

layer using, for example, a spin coating technique, and is subjected to a light exposure to form photoresist patterns on a location corresponding to the first and second semiconductor layers 110 and 210. Using the photoresist patterns as a mask, the polycrystalline silicon layer is wet- or dry-etched to form the first and second semiconductor layers 110 and 210. The photoresist patterns are removed.

Subsequently, as shown in Figs. 3 and 4, a gate insulating layer 420 is formed over the whole surface of the base substrate to cover the first and second semiconductor layers 110 and 210. The gate insulating layer 420 serves to insulate the first and second semiconductor layers 110 and 210, respectively, from first and second gate electrodes of the first and second TFTs 100 and 200 that will be formed in a subsequent process.

Thereafter, a first metal layer is deposited on the gate insulating layer 420 using, for example, a sputtering technique in a predetermined thickness. The first metal layer comprises a metal such as aluminum (Al) and aluminum-neodymium alloy (Al:Nd). As shown in Figs. 5, 6 and 19 the first metal layer is patterned to form a first gate electrode 120 of the first TFT 100, a second gate electrode 220 of the second TFT 200, a first capacitor electrode 310 of the storage capacitor 300, and a gate line 430. Subsequently, an n-type or a p-type impurity is ion-implanted into the first and second semiconductor layers 110 and 220 to form first source and drain regions 130 and 140 of the first TFT 100 and second source and drain regions 240 and 230 of the second TFT 200.

For more detail, on a portion of the gate insulating layer 420 corresponding to the first semiconductor layer 110, the first gate electrode 120

having a smaller area size than the first semiconductor layer 110 is formed, and the gate line 430 is arranged in a transverse direction to be spaced apart from the first semiconductor layer 110 and is connected to the first gate electrode 120.

As shpwn in Figs. 5 and 6, at this point, the first semiconductor layer 110 includes the source and drain regions 130 and 140, respectively, formed on both end portions thereof. The first capacitor electrode 310 is formed between the first and second gate electrodes 120 and 220 in such a way that it is spaced apart from the drain region 140 of the first semiconductor layer 110 and is connected to the second gate electrode 220.

On a portion of the gate insulating layer 420 corresponding to the second semiconductor layer 210, the second gate electrode 220 having a smaller area size than the second semiconductor layer 210 is formed. At this point, the second semiconductor layer 210 includes the drain and source regions 230 and 240, respectively, formed on both end portions thereof.

As shown in Figs. 7 and 8, an interlayer insulator 440 is formed over the whole surface of the base substrate 400 to cover the first and second gate electrodes 120 and 220, and the first capacitor electrode 310. The interlayer insulator 440 serves to insulate the first and second gate electrodes 120 and 220 from first source and drain electrodes 182 and 184 and second source and drain electrodes 282 and 284, which will be formed in a subsequent process. A portion of the interlayer insulator 440 corresponding to the first capacitor electrode 310 serves as a dielectric layer of the storage capacitor 300.

As shown in Figs. 9 and 10, the interlayer insulator 440 includes first

source and drain contact holes 172 and 174 and second drain and source contact holes 272 and 274. The first source and drain contact holes 172 and 174 are formed at locations corresponding to the first source and drain regions 130 and 140, and the second drain and source contact holes 272 and 274 are formed at locations corresponding to the second drain and source regions 230 and 240. The interlayer insulator 440 further includes a capacitor contact hole 320 at a location corresponding to a portion of the first capacitor electrode 310 adjacent to the first drain region 140.

Subsequently, a second metal layer is deposited on the interlayer insulator 440 using, for example, a sputtering technique. As shown in Figs. 11, 12 and 19, the second metal layer is patterned to form first source and drain electrodes 182 and 184 of the first TFT 100, second source and drain electrodes 282 and 284 of the second TFT 200, a second capacitor electrode 330 of the storage capacitor 300, a data line 450, and a common power line 460.

The data line 450 is arranged in a perpendicular direction to the gate line 430 and is connected to one end portion of the first source electrode 182, and the other end portion of the first source electrode 182 overlaps over one end portion of the first gate electrode 120. The first source electrode 182 is electrically connected to the first source region 130 through first source contact hole 172. One end portion of the first drain electrode 184 overlaps over the other end portion of the first gate electrode 120, and the other end portion of the first drain electrode 184 overlaps over an end portion of the first capacitor electrode 310. The first drain electrode 184 is electrically connected to the first drain region 140 and the first capacitor electrode 310, respectively, through the

first drain contact hole 174 and the capacitor contact hole 320. The common power line 460 is arranged in a perpendicular direction to the gate line 430 and is opposite to the data line 450. The second capacitor electrode 330 is connected to the common power line 460 and overlaps over the first capacitor electrode 310. The second drain electrode 284 has one end portion overlapping over one end portion of the second gate electrode 220, and second source electrode 282 has one end portion overlapping over the other end portion of the second gate electrode 220 and the other end portion extending from the common power line 460. The second drain electrode 284 is electrically connected to the second drain region 230 through the second drain contact hole 272, and the second source electrode 282 is electrically connected to the second source region 240 through the second source contact hole 274.

Subsequently, as shown in Figs. 13 and 14, a planarization film 470 is formed over the whole surface of the base substrate 400 to cover the first source and drain electrodes 182 and 184, the second source and drain electrodes 282 and 284, the second capacitor electrode 330, the data line 450, and the common power line 460. The planarization film 470 includes a third drain contact hole 475 (see Fig. 15) at a location corresponding to a portion of the second drain electrode 284.

Finally, as shown in Figs. 15 and 16, a conductive material layer is deposited on the planarization film 470 and is patterned to from an interface pad 480. The interface pad 480 is electrically connected to the second drain electrode 284 through the third drain contact hole 475. Therefore, the TFT array substrate 500 is completed.

The manufactured TFT array substrate 500 is then assembled with the organic EL substrate 900.

Fig. 17 is a cross-sectional view illustrating the organic EL substrate 900 according to the first preferred embodiment of the present invention.

First, a protection film 620 is formed on a transparent substrate or second insulating substrate 610. Preferably, the protection film is made of SiO_2 or SiNx. The protection film 620 serves to shield oxygen and moisture coming into through the transparent substrate 610. That is, the protection film 920 plays the same role as the conventional metal can. Thereafter, a transparent electrode 630 is deposited on the protection film 620 in a predetermined thickness. Preferably, the transparent electrode 630 is made of indium tin oxide or indium zinc oxide. Subsequently, an organic EL layer 640 is formed on the transparent electrode 630. The organic EL layer 640 includes one of a red organic EL material, a green organic EL material, and a blue organic EL material. Finally, a metal_electrode 650 is formed on the organic EL layer 640. Therefore, the organic EL substrate 900 according to the first preferred embodiment of the present invention is completed.

Figs. 18 and 20 are cross-sectional views illustrating the organic EL device in which the TFT array substrate 500 is assembled with the organic EL substrate 900 according to the first preferred embodiment of the present invention.

In order to assemble the TFT array substrate 500 and the organic EL substrate 900, for example, in a vacuum chamber (not shown), the TFT array substrate 500 is aligned with the organic EL substrate 900 to face the interface

pad 480 of the TFT array substrate 500 toward the metal electrode 650 of the organic EL substrate 900. Thereafter, an UV-curable agent 910 is coated on the side of the TFT array substrate 500 and the organic EL substrate 900 as shown in Fig. 20 and then is cured by an ultraviolet ray. When the TFT array substrate 500 and the organic EL substrate 900 that the UV-curable agent is cured come out of the vacuum chamber, the TFT array substrate 500 and the organic EL substrate 900 are closely stuck to each other due to a vacuum pressure, so that an electric current can flow from the interface pad 480 of the TFT array substrate 500 to the metal electrode 650 of the organic EL substrate 900.

Fig. 21 is a perspective view illustrating a TFT array substrate 500 according to a second preferred embodiment of the present invention.

The TFT array substrate 500 includes a bump pad 490 in addition to a configuration of the TFT array substrate 500 of Fig. 16. At this point, the interface pad 480 is made of a conductive resin, a metal alloy, or a conductive metal such as Al, Pd, Au, Ti, TiW, NiCr, Cr, Nd, AlNd, and Pt, and has a thickness of about 300 Å to about 20000 Å. The bump pad 490 is formed using an electroplating technique, a non-electrolysis plating technique, a sputtering technique, a spin coating technique, or a chemical vapor deposition (CVD) technique. The bump pad 490 comprises Ni, Au, PbSn, In, or polymer.

The TFT array substrate 500 of Fig. 21 is assembled with a organic EL substrate. Figs. 22 to 25 are cross-sectional view illustrating a process of manufacturing the organic EL substrate 600 according to the second preferred embodiment of the present invention.

First, as shown in Fig. 22, a transparent electrode is formed on a

transparent substrate 610 to a predetermined thickness. The transparent electrode 620 is made of a transparent material such as indium tin oxide (ITO) or indium zinc oxide (IZO).

Thereafter, as shown in Fig. 23, an organic EL layer 630 is formed on the transparent electrode 620 using a shadow mask 640. The organic EL layer 630 includes one of a red organic EL material, a green organic EL material and a blue organic EL material. The shadow mask 640 includes an opening portion 645. The opening portion 645 is formed at a location corresponding to the organic EL layer 630.

Subsequently, as shown in Fig. 24, a conductive metal layer is deposited on the organic EL layer 630 through the opening portion 655 of the shadow mask 650 to form a metal electrode 660.

As shown in Fig. 25, a protection film 670 is formed to overlap both end portions of the metal electrode 660 using a photolithography technique, exposing an upper surface of the metal electrode 660.

Next, as shown in Fig. 26, an anisotropic conductive film (ACF) 680 is formed over the whole surface of the transparent substrate 610 in a predetermined thickness. The anisotropic conductive film 680 has both adhesive force and conductivity. In other words, the anisotropic conductive film 680 is configured in a way that conductive particles are finely arranged among adhesive materials, and therefore, when the anisotropic conductive film 680 is pressurized, electrons can flow through the conductive particles. Such an anisotropic conductive film 680 is used to enable an electric current to flow from one conductive material to another conductive material by an attachment

method other than a soldering method.

The organic EL substrate 600 on which the anisotropic conductive film 680 is formed is aligned with the TFT array substrate 500 to face the anisotropic conductive film 680 of the organic EL substrate 600 toward the bump pad 490 of the TFT array substrate 500.

Then, as shown in Fig. 27, the TFT array substrate 500 and the organic EL substrate 600 are heated, pressurized, and UV-treated to be glued to each other. As a result, not only the TFT array substrate 500 and the organic EL substrate 600 are firmly stuck to each other, but also electrons can travel from the bump pad 490 to the metal electrode 660.

A portion of the anisotropic conductive film 680 where a movement of electrons does not occur serves to shield the organic EL device from oxygen and moisture. That is, the portion of the anisotropic conductive film 680 where a movement of electrons does not occur plays the same role as the conventional metal can.

When the TFT array substrate 500 and the organic EL substrate 600 are assembled using the anisotropic conductive film 680, a much stronger adhesive force can be obtained than using the UV-curable agent 960 of Fig. 20. In addition, electric characteristics such as a signal delay coming from a contact resistance between the interface pad 480 and the metal electrode 950 of Fig. 20 can be improved.

Figs. 28 to 30 are cross-sectional views illustrating a process of manufacturing a organic EL substrate according to a third preferred embodiment of the present invention.

First, a transparent material layer is deposited on a transparent substrate 710 and patterned to form a transparent electrode 720. Preferably, the transparent substrate 710 is made of glass, and the transparent electrode 720 is made of indium tin oxide (ITO) or indium zinc oxide (IZO).

Thereafter, a polymer bump 730 is formed on the transparent electrode 720. Preferably, the polymer bump 730 is made of photoresist, acryl, or polyimide. The polymer bump 730 is formed at a location adjacent to a location 731 defined by a dotted line where an organic EL layer will be formed in a subsequent process. The polymer bump 730 has a higher height than a summation of a height of the organic EL layer and a height of a metal electrode which will be formed in subsequent process.

Subsequently, as shown in Fig. 29, a shadow mask 740 is aligned with the array substrate so that the shadow mask 740 may be laid across the polymer bump 730.

The shadow mask 740 includes an opening portion 745 that is somewhat wider in area size than the location 731, and a portion of the opening portion 745 of the shadow mask 740 is arranged on a portion of the polymer bump 730. Then, an organic EL material is deposited on the transparent electrode 720 through the opening portion 745 of the shadow mask to form an organic EL layer 750. The organic EL layer 750 overlaps a portion of the polymer bump 730 and thus has a step portion. The organic EL layer 750 has a somewhat larger area size than substantially needed.

Next, as shown in Fig. 30, a metal layer is deposited on the organic EL layer 750 through the opening portion 745 of the shadow mask 740 to form a

metal electrode 760. The anode electrode 760 has the same shape and area size as the organic EL layer 750.

Meanwhile, for the sake of a precise process, it is preferable that the shadow mask 740 has as thin thickness as possible. However, as a thickness of the shadow mask become thinner, a bending of the shadow mask 740 becomes larger. As a result, it is very difficult to secure a pattern area of the organic EL layer 750 and the metal electrode 760. For the reason, a portion of the shadow mask 740 is laid across the polymer bumper 730.

As described above, a portion of the organic EL layer 750 overlaps a portion of the polymer bump 730. This is to increase an adhesive force between the metal electrode 760 and the bump pad 490 and to prevent a short circuit between two adjacent metal electrodes without an additional protection film.

Subsequently, as shown in Fig. 31, an anisotropic conductive film 770 is formed over the whole surface of the organic EL substrate 700 to cover the metal electrode 760. Then, the organic EL substrate 700 is aligned with the TFT array substrate 500 of Fig. 21 to face the anisotropic conductive film 770 of the organic EL substrate 700 toward the bump pad 490 of the TFT array substrate 500.

Then, as shown in Fig. 32, the TFT array substrate 500 and the organic EL substrate 700 are heated, pressurized, and UV-treated to be glued to each other. As a result, not only the TFT array substrate 500 and the organic EL substrate 700 are firmly stuck to each other, but also electrons can travel from the bump pad 490 to the metal electrode 760.

As another exemplary, a method may be used that a solder is coated on

the bump pad 490 and then melted to solder the bump pad 490 of the TFT array substrate 500 and the metal electrode 760 of the organic EL substrate 700.

[Effect of the Invention]

As described herein before, using a method of manufacturing the organic EL device according to the preferred embodiments of the present invention, an organic EL device having a high aperture ratio, a high luminance, and a low power consumption can be obtained. In addition, an organic EL device having a high reliability and a lightweight can be obtained.

While the invention has been particularly shown and described with reference to preferred embodiments thereof, it will be understood by those skilled in the art that the foregoing and other changes in form and details may be made therein without departing from the spirit and scope of the invention.

What is claimed is:

1. An organic EL device, comprising:

a driving circuit substrate including:

a first substrate;

a first display power supplying means formed on a predetermined part of the first substrate and supplying a first display power to an outside; and

a power supplying pad connected to an output terminal of the first display power supplying means and receiving the first display power;

a display substrate including:

a second substrate;

a first transparent electrode formed on the second substrate and receiving a second display power;

an organic emitting layer formed on an upper part of the first electrode and for generating a light having a predetermined wavelength; and

a second electrode fromed on an upper part of the organic emitting layer and electrically connected to the power supplying pad.

2. The device of claim 1, wherein the organic EL device further includes an insulating layer between the first display power supplying means and the power supplying pad, and the power supplying pad is electrically connected to the output terminal therough a contact hole formed on the insulating layer.

3.The device of claim 1, wherein the organic EL substrate further includes a protection film for shielding oxygen and moisture externally coming into between the second substrate and the first electrode.

4.The device of claim 3, wherein the protection film is formed by repeatedly depositing a SiNx layer and a SiO_2 layer at least one time.

5.The device of claim 4, wherein the first substrate and the second substrate are assembled in a vacuum circumstance, and edges of the first substrate and the second substrate are sealed with a UV-curable agent.

6.The device of claim 1, wherein the power supplying pad and the second electrode are adhered by a conductive bonding agent.

7.The device of claim 6, wherein the conductive bonding agent is an anisotropic conductive film (ACF).

8.The device of claim 7, wherein a conductive bump pad is formed on an upper part of the power supplying pad, a protection film is formed on the second electrode in order to only expose the second electrode and the conductive bump pad and an exposure part of the second electrode are bonded by a conductive bonding agent to prevent a moisture/oxyge from being contacted with the organic emitting layer.

9.The device of claim 1, wherein a condcuctive bump pad is formed on an upper part of the power supplying pad, a polymer bump pad is formed on a part opposite to the conductive bump pad on an upper part of the first electrode of the display substrate, the organic emitting layer and the second electrode are formed on upper parts of the polymer bumo and the first electrode and the conductive bump pad and an exposure part of the second electrode are bonded by a conductive bonding agent to prevent a moisture/oxyge from being contacted with the organic emitting layer.

10.The device of claim 9, wherein the organic emitting layer and the second eletrode are formed on a part of upper part of the polymer bump.

11.A method of manufacturing an organic EL device, comprising:

forming a first display power supplying means for supplying a first display power to an outside on a first substrate;

manufacturing a driving circuit substrate by extending an output terminal of the first display power supplying means to an upper part of the insulating material to form a power supplying pad in the state of insulating the first display power supplying means by an insulating material;

manufacturing a display substrate by sequentially forming a first electrode on a transparent second electrode, the organic emitting layer on the first electrode and a second electrode onthe organic emitting layer;

aligning the driving circuit substrate and the display substrate on a vacuum circumstance to adhere closely each other by the second electrode of the display substrate and the power supplying pad of the driving circuit substrate; and

sealing the first substrate and the second substrate by coating edges of the first substrate and the second substrate with a bonding agent.

12.The method of claim 11, wherein extending an output terminal of the first display power supplying means to an upper part of the insulating material comparises

forming a portion corresponding to the output terminal of the insulating material; and

forming a conductive material of a predetermined thickness on an outer part of the insulating material and an inner part of the contact hole.

13.The method of claim 11, wherein the second substrate further includes a protection film for shielding oxygen and moisture externally coming into.

14.A method of manufacturing an organic EL device, comprising:

forming a first display power supplying means for supplying a first display power to an outside on a first substrate;

manufacturing a driving circuit substrate by extending an output terminal of the first display power supplying means to an upper part of the insulating material to form a power supplying pad in the state of insulating the first display power supplying means by an insulating material and forming a conductive bump pad on an upper part of the power supplying pad;

manufacturing a display substrate by sequentially forming a first electrode on a transparent second electrode, the organic emitting layer on the first electrode and a second electrode ont he organic emitting layer, and forming a protection film in order to only expose the second electrode;

forming a conductive bonding agent to one of one side of the protection film and one side of the conductive bump pad; and

transforming the conductive bonding agent in order to generate an electron flow between the conductive bump pad and the second electrode.

15.The method of claim 14, wherein the conductive bonding agent is an anisotropic conductive film (ACF) and is transformed by one of a heat, a pressure, and UV.

16.A method of manufacturing an organic EL device, comprising:

forming a first display power supplying means for supplying a first display power to an outside on a first substrate;

manufacturing a driving circuit substrate by extending an output terminal of the first display power supplying means to an upper part of the insulating material to form a power supplying pad in the state of insulating the first display power supplying means by an insulating material and forming a conductive bump pad on an upper part of the power supplying pad;

sequentially forming a first electrode on a transparent second electrode, a polymer bump protruded on an opposite side to the conductive bump pad on the first electrode, an organic emitting layer on the part from an upper part of the polyme bump to a predetermined position of the first electrode, and a second electrode on the organic emitting layer;

forming a conductive bonding agent to one of one side of the protection film and one side of the conductive bump pad; and

transforming the conductive bonding agent in order to generate an electron flow between the conductive bump pad and the second electrode.

17.The method of claim 16, wherein forming the organic emitting layer and the second electrode further includes receiving the organic emitting layer, the second electrode and a shadow mask having a opening portion to include an upper portion of the polymer bump; and sequentially forming the organic emitting layer and the second electrode tthrough the shadow mask.

FIG.1

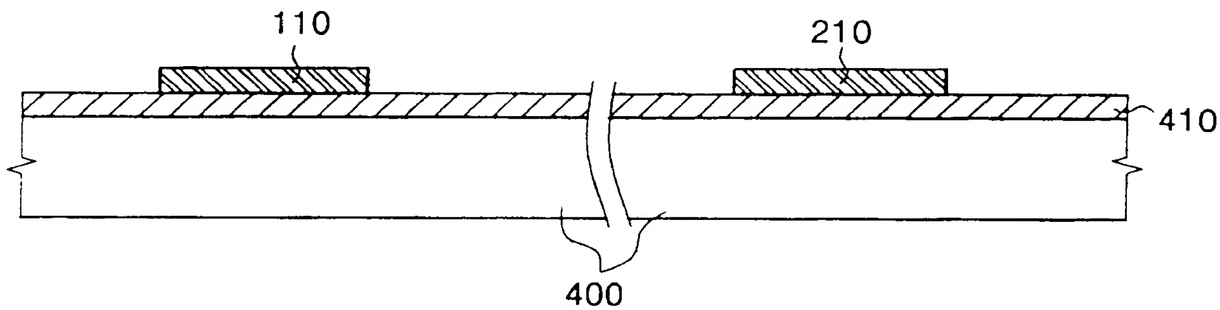


FIG.2

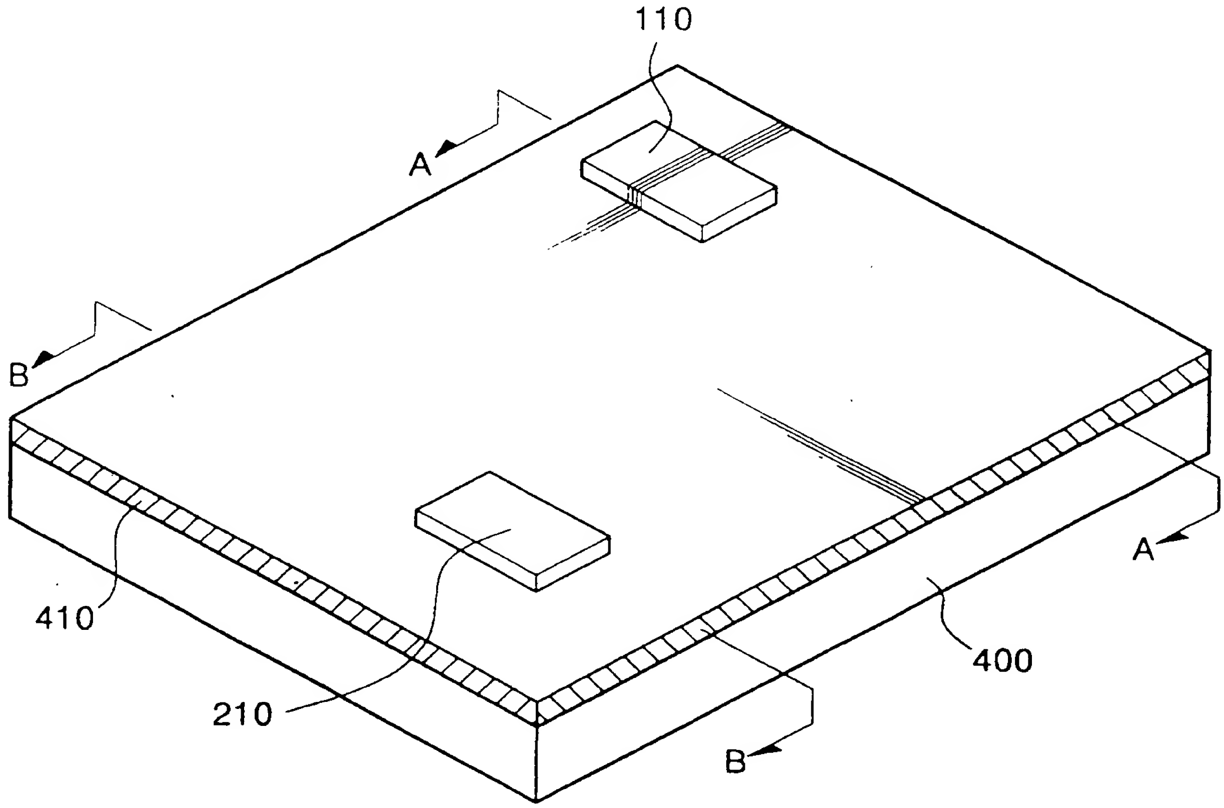


FIG.3

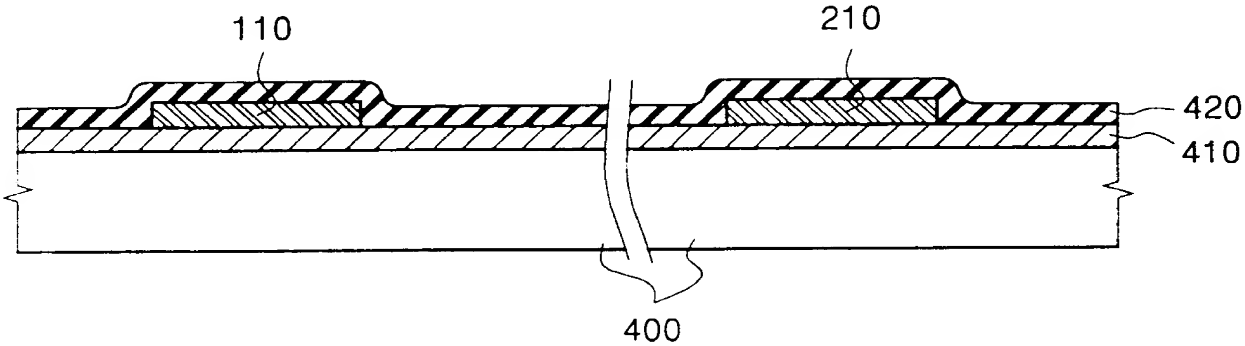


FIG.4

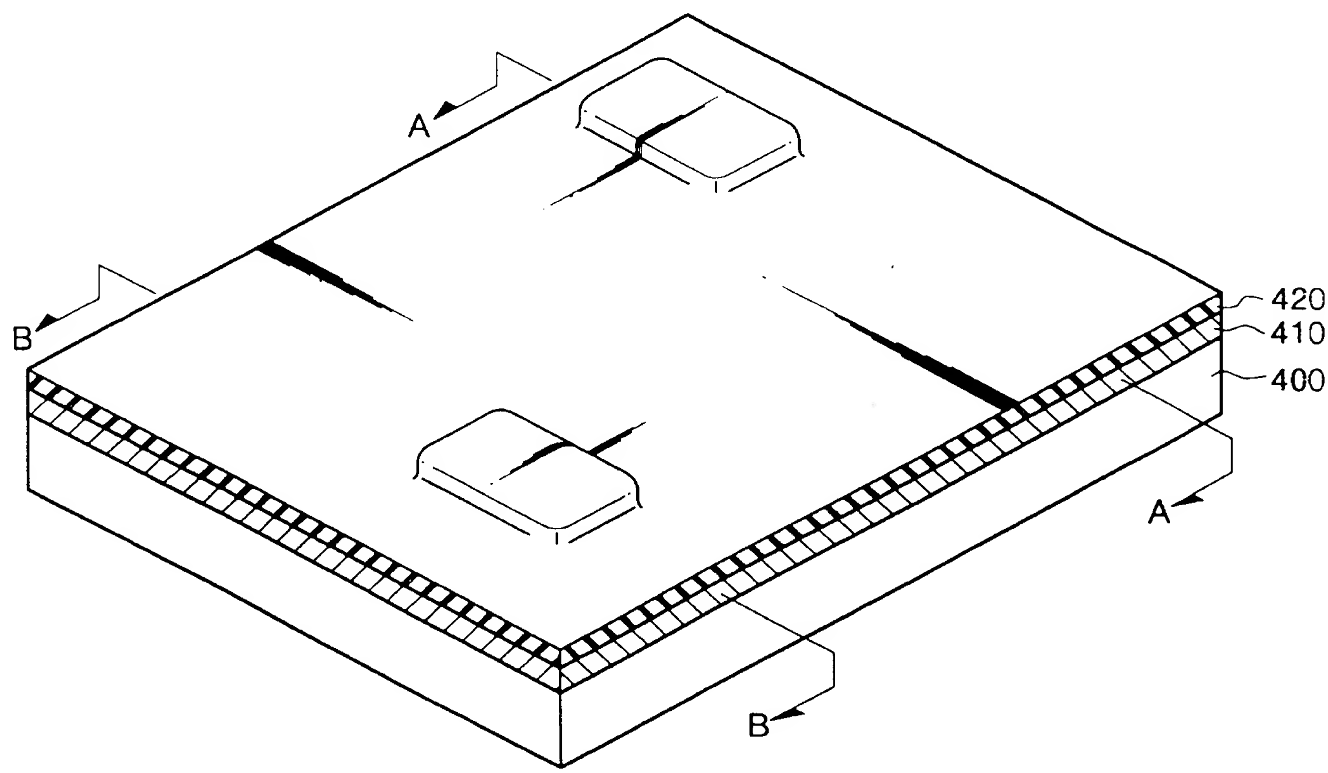


FIG.5

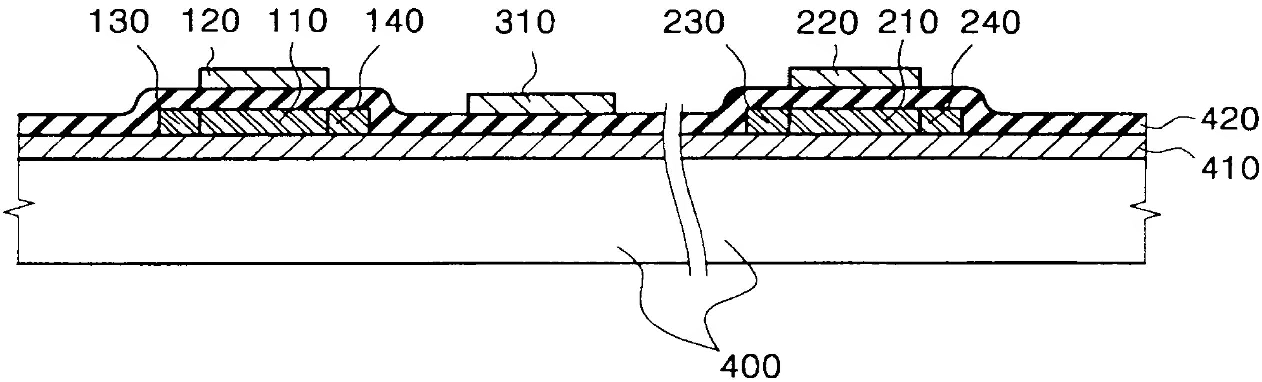

130
120
110
140
310
230
220
210
240
420
410
400

FIG.6

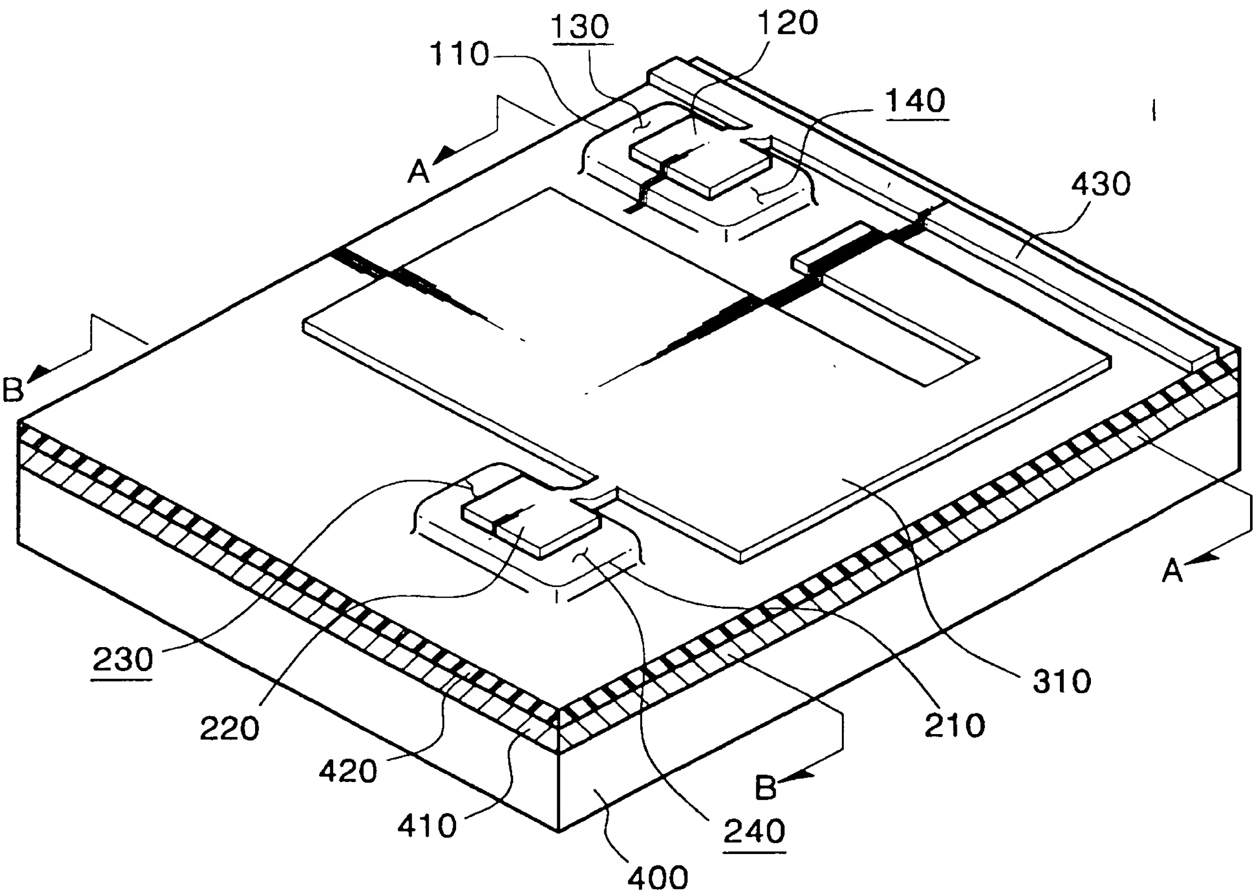

110
130
120
140
430
A
B
310
230
220
210
420
410
240
400

FIG.7

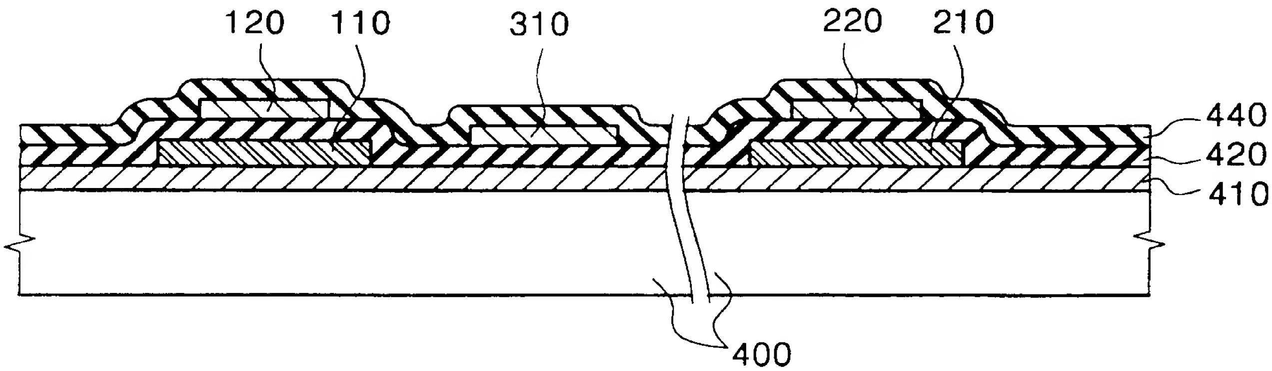


FIG.8

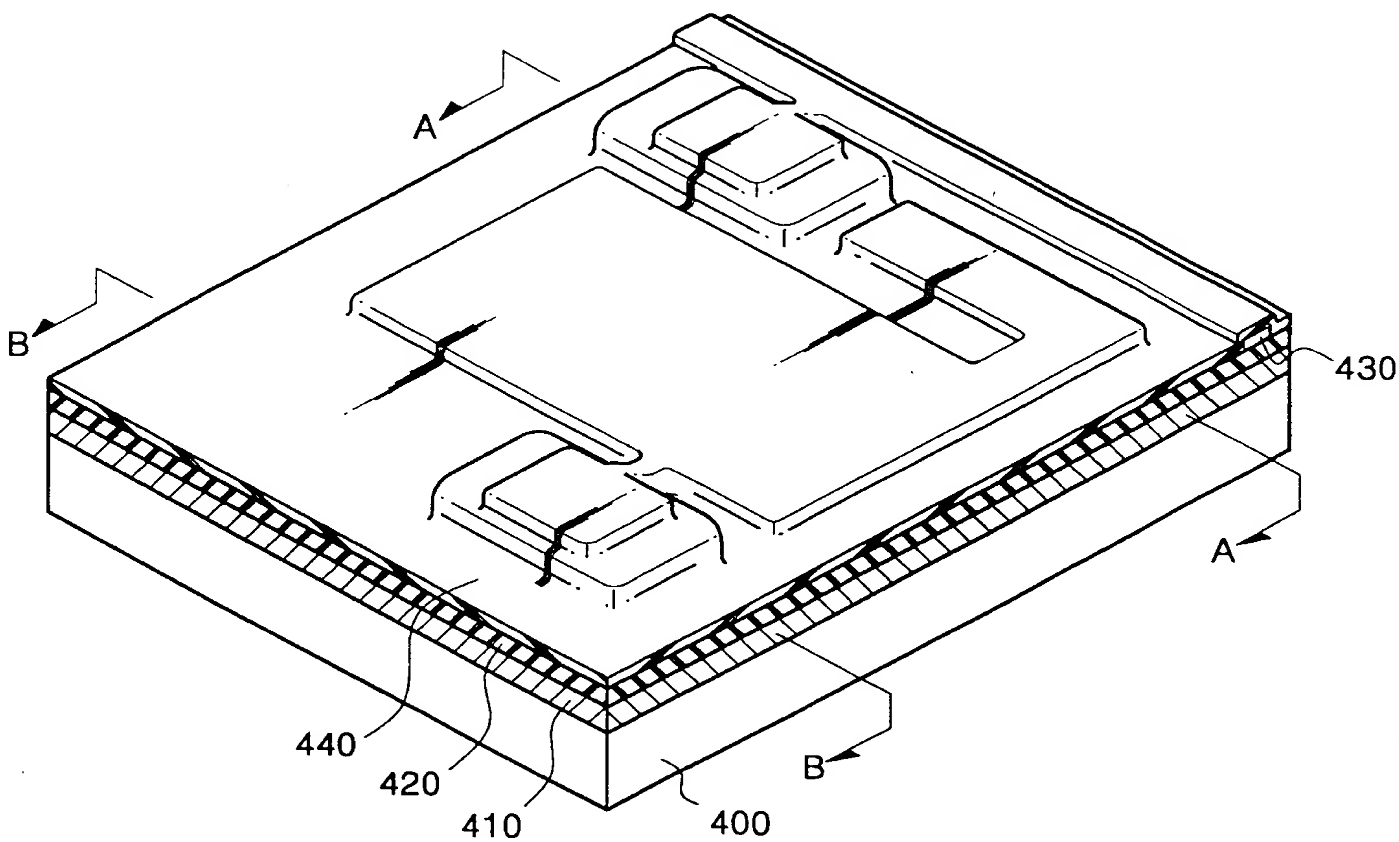
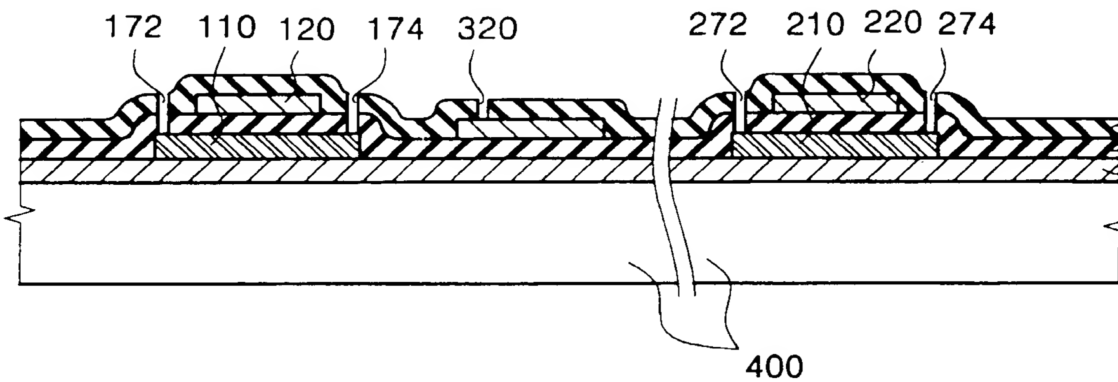
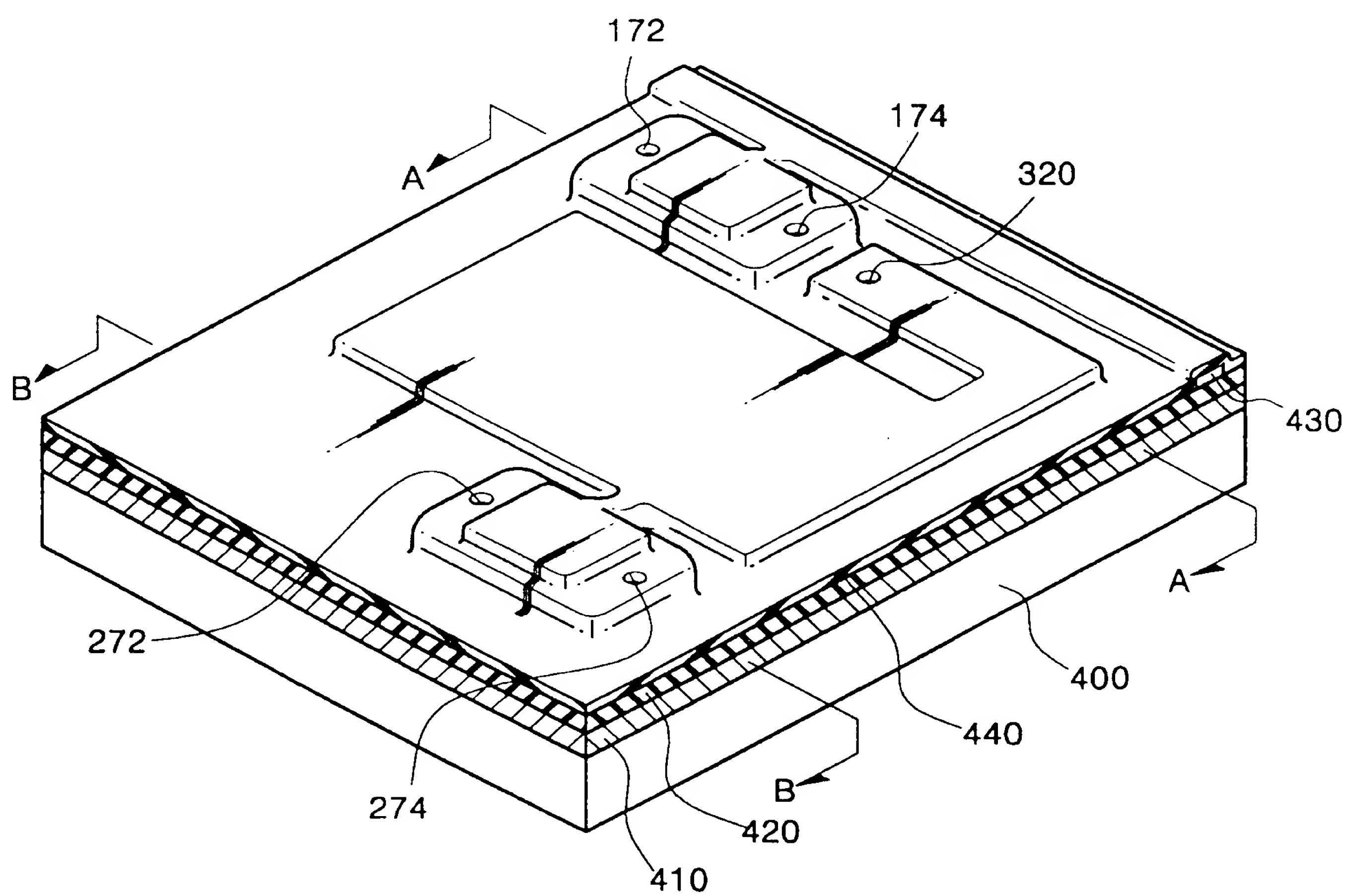


FIG.9



172
110
120
174
320
272
210
220
274
440
420
410
400

FIG.10



172
174
320
A
B
430
A
272
400
440
B
274
420
410

FIG.11

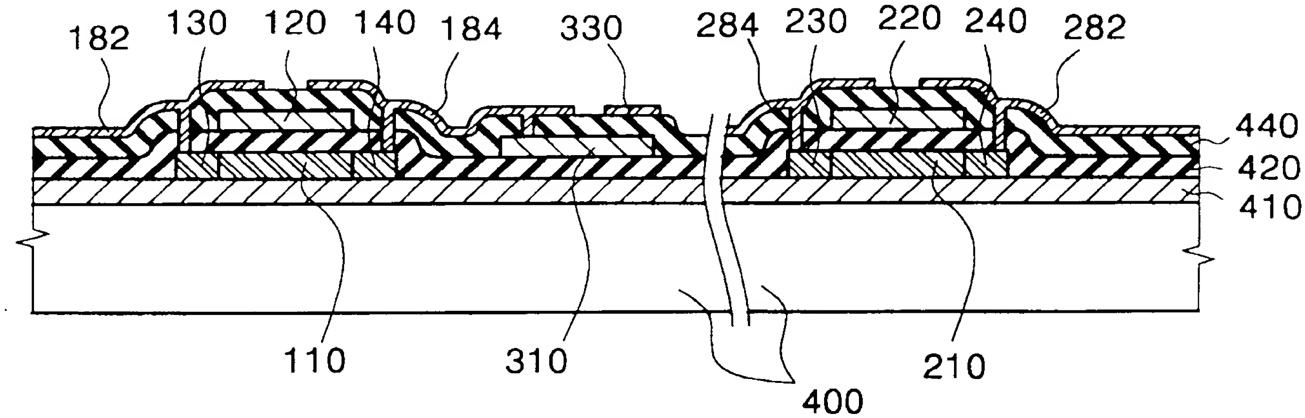

182
130
120
140
184
330
284
230
220
240
282
440
420
410
110
310
400
210

FIG.12

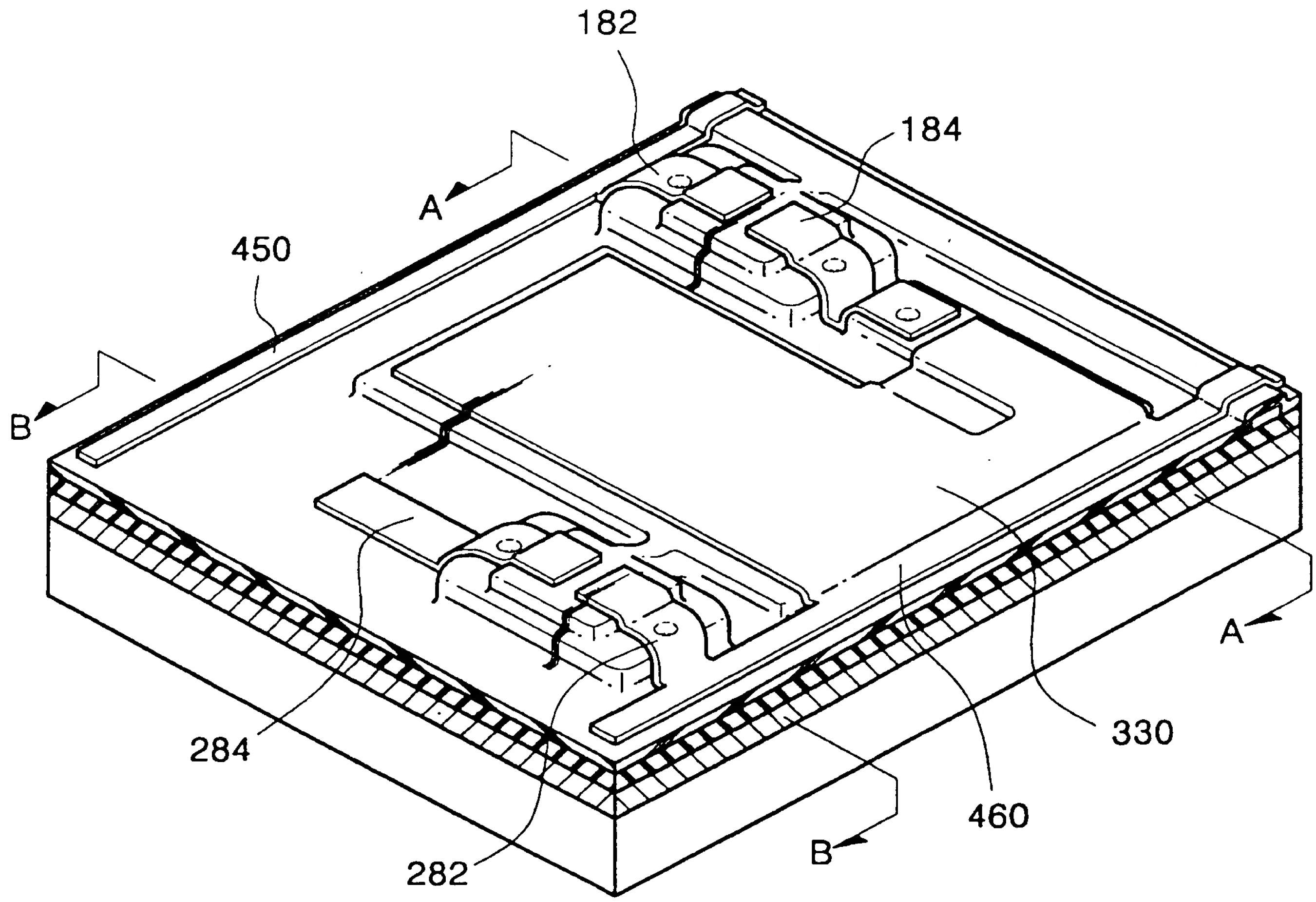

182
184
A
450
B
A
330
460
284
282
B

FIG.13

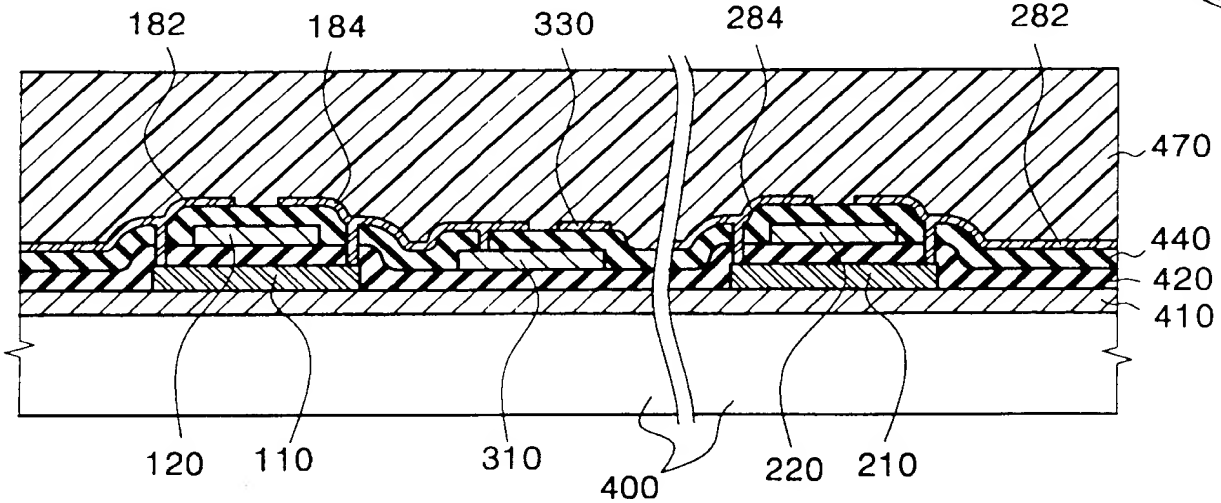

182
184
330
284
282
470
440
420
410
120
110
310
400
220
210

FIG.14

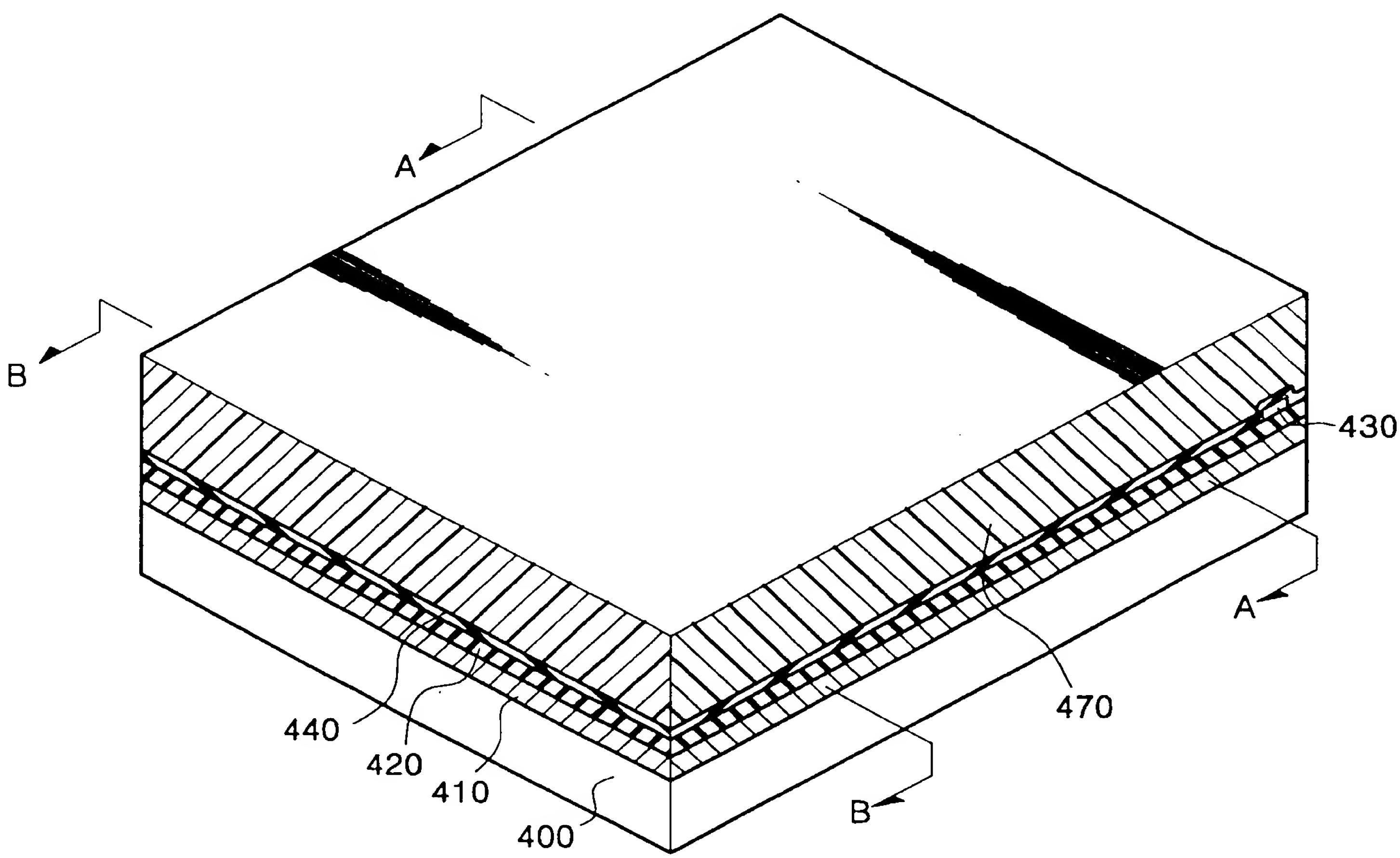

A
B
430
A
470
440
420
410
400
B

FIG.15

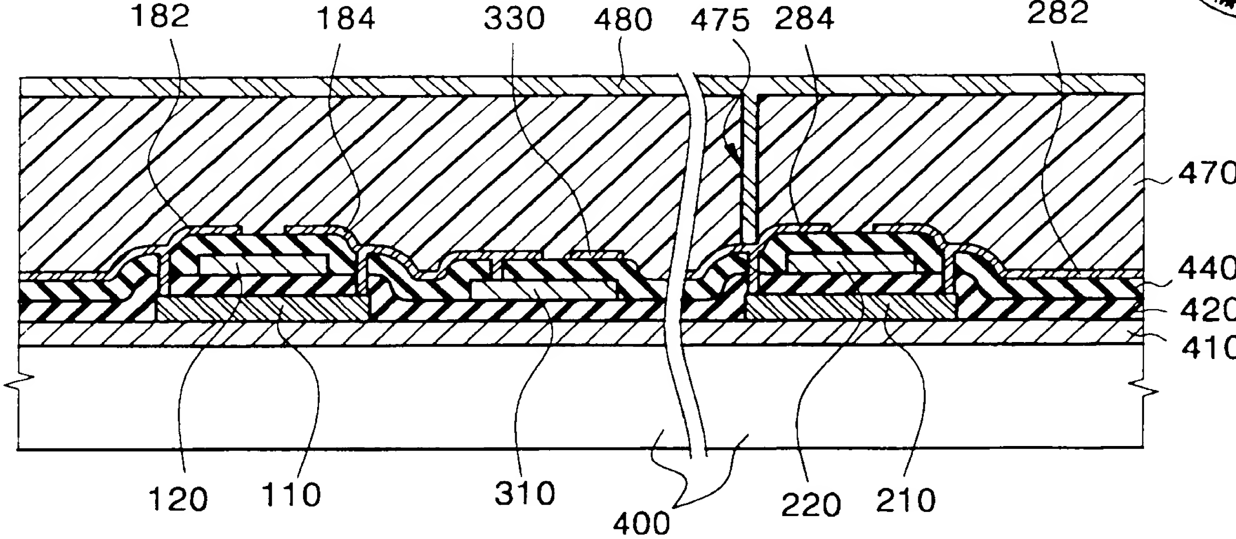

182
184
330
480
475
284
282
470
440
420
410
120
110
310
400
220
210

FIG.16

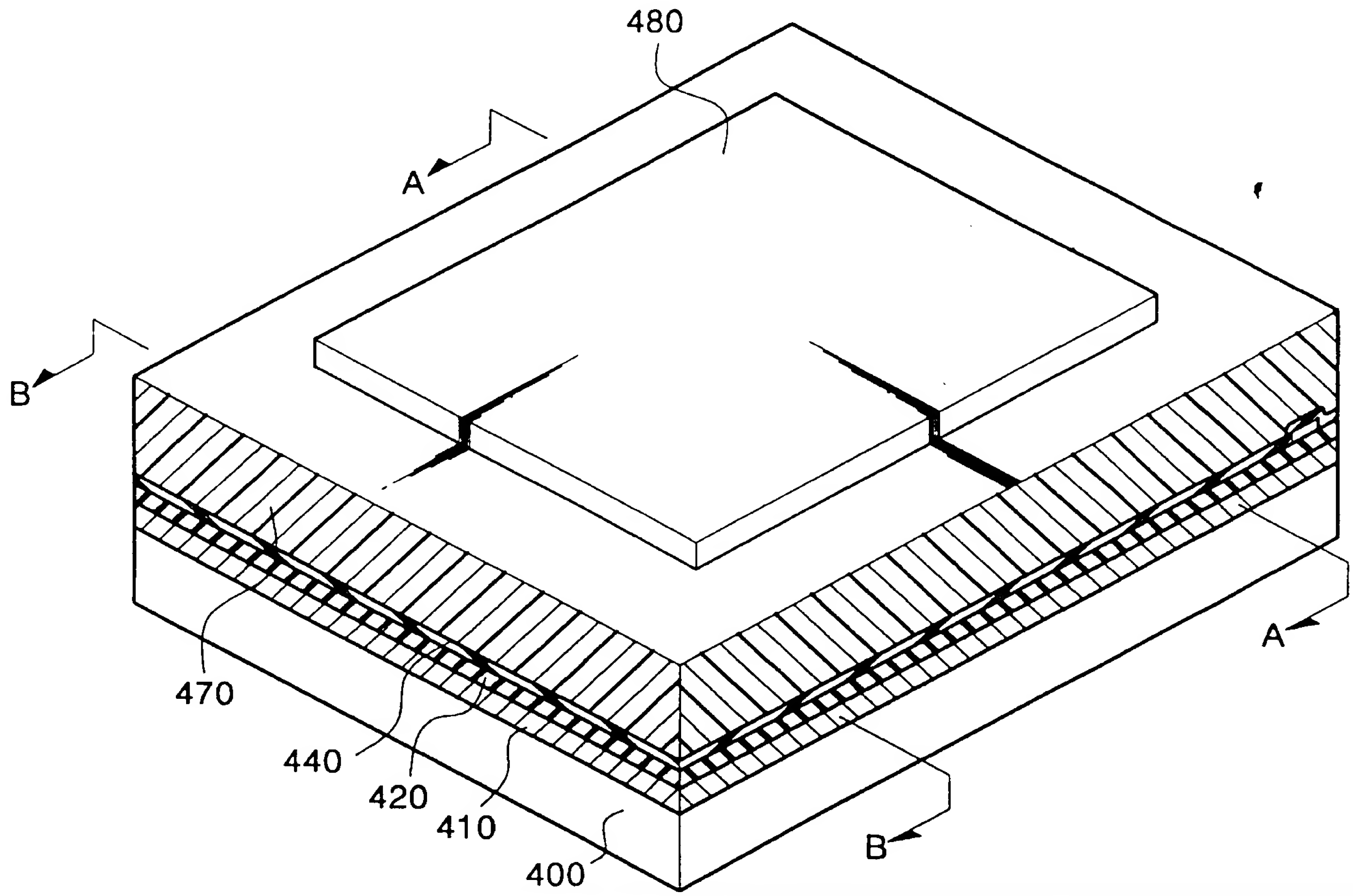

480
A
B
470
440
420
410
400
A
B

FIG.17

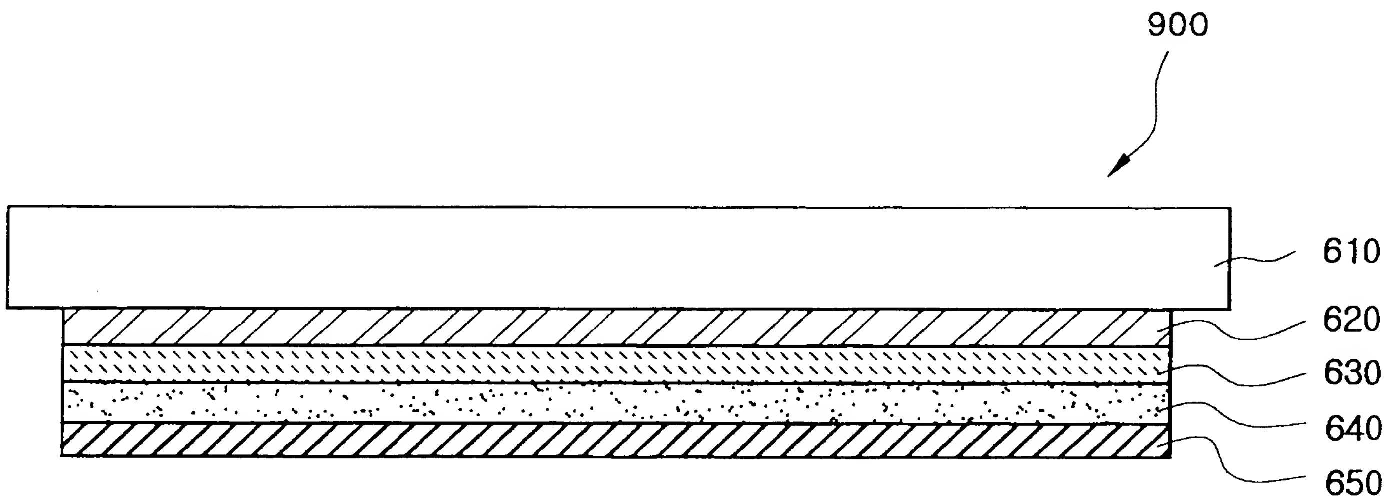


FIG.18

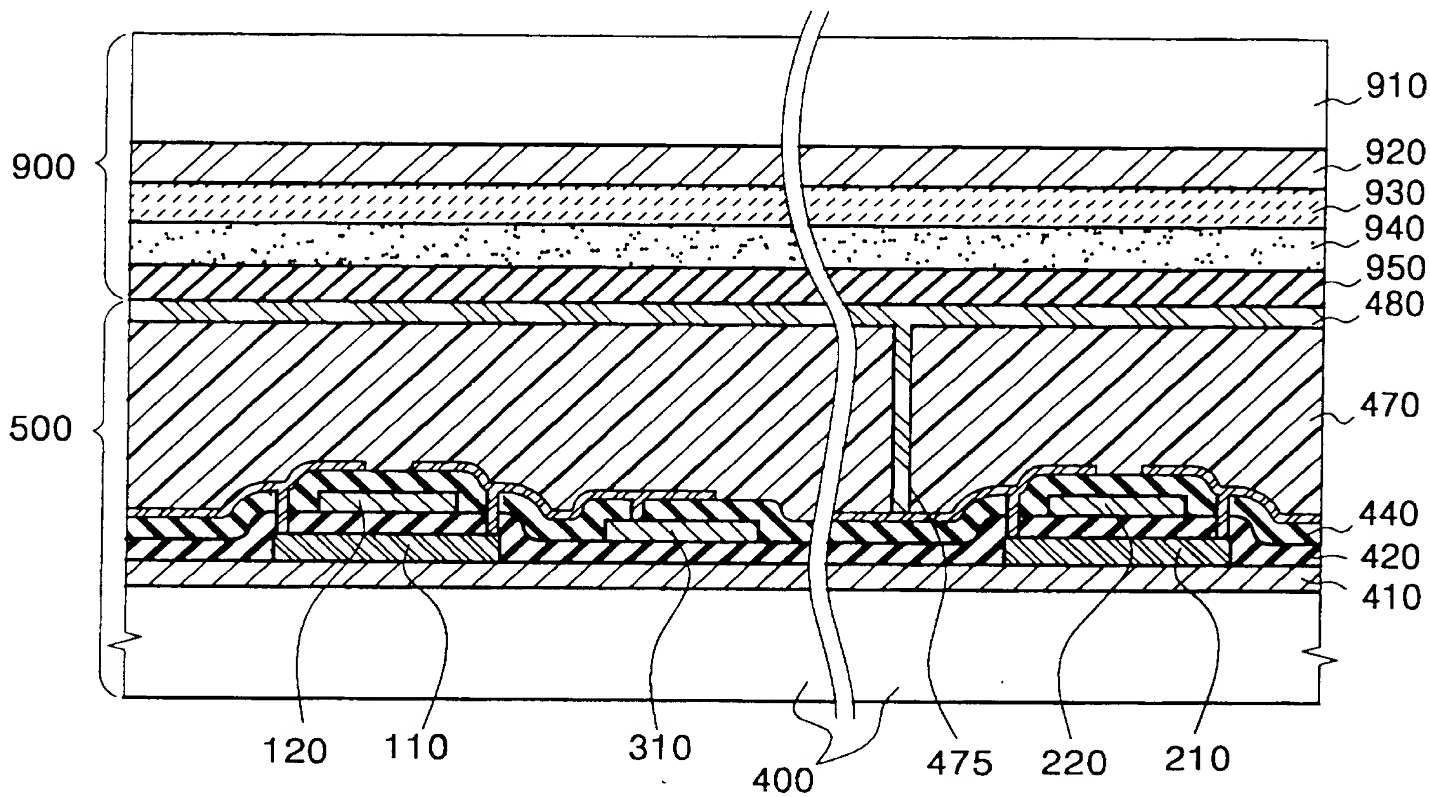

900
500
910
920
930
940
950
480
470
440
420
410
120
110
310
400
475
220
210

FIG. 19

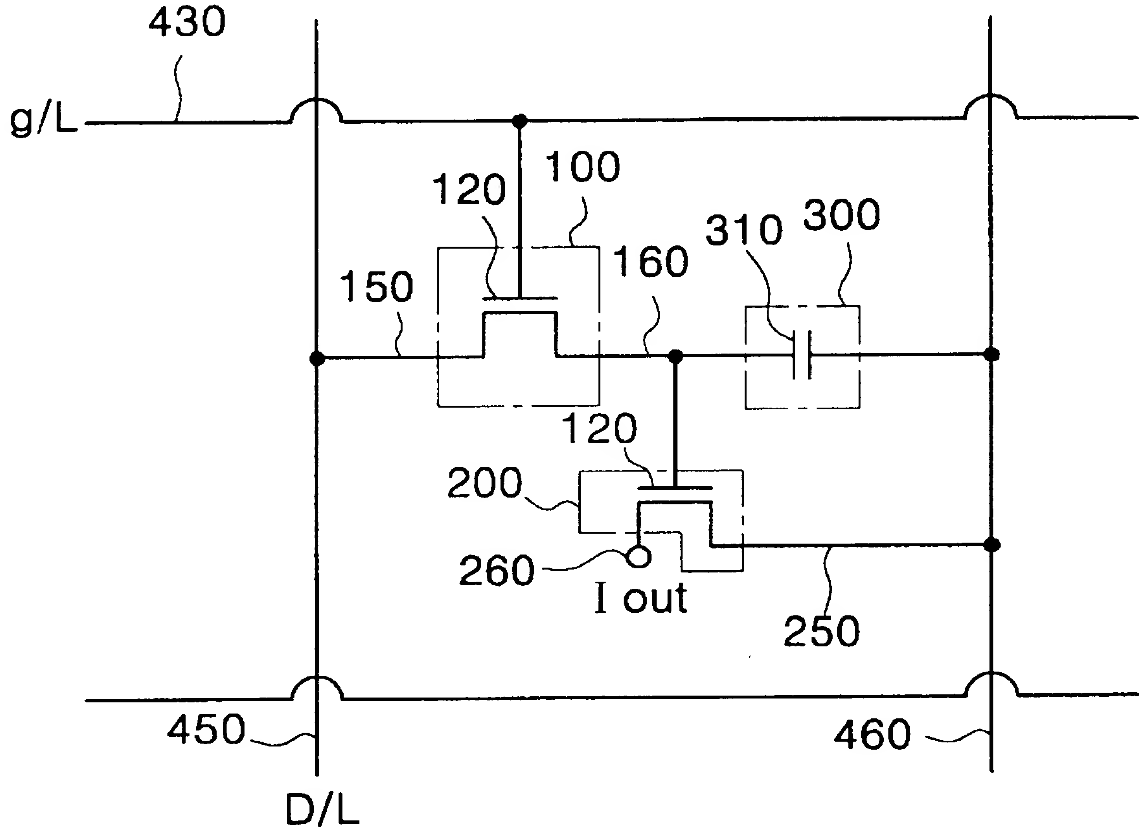


FIG.20

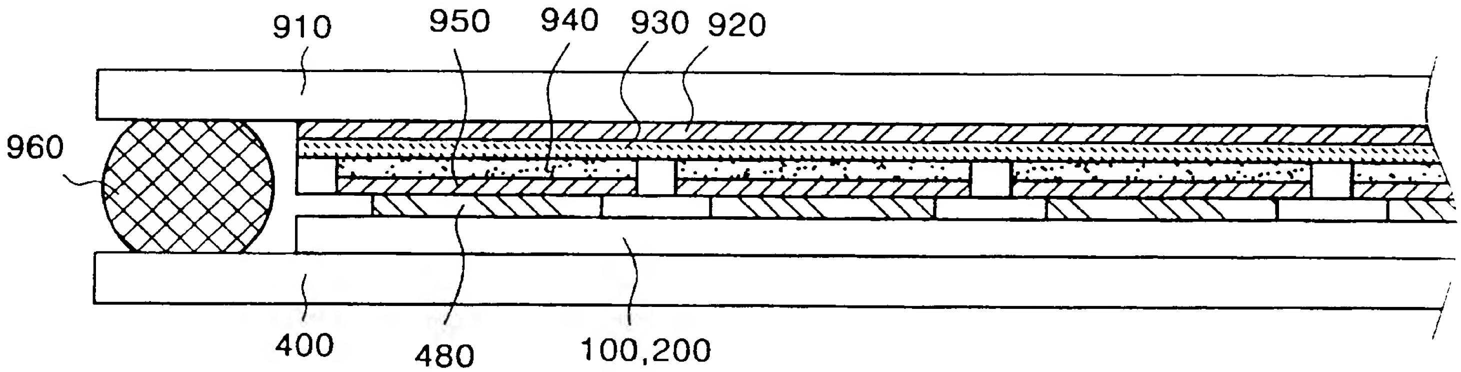


FIG.21

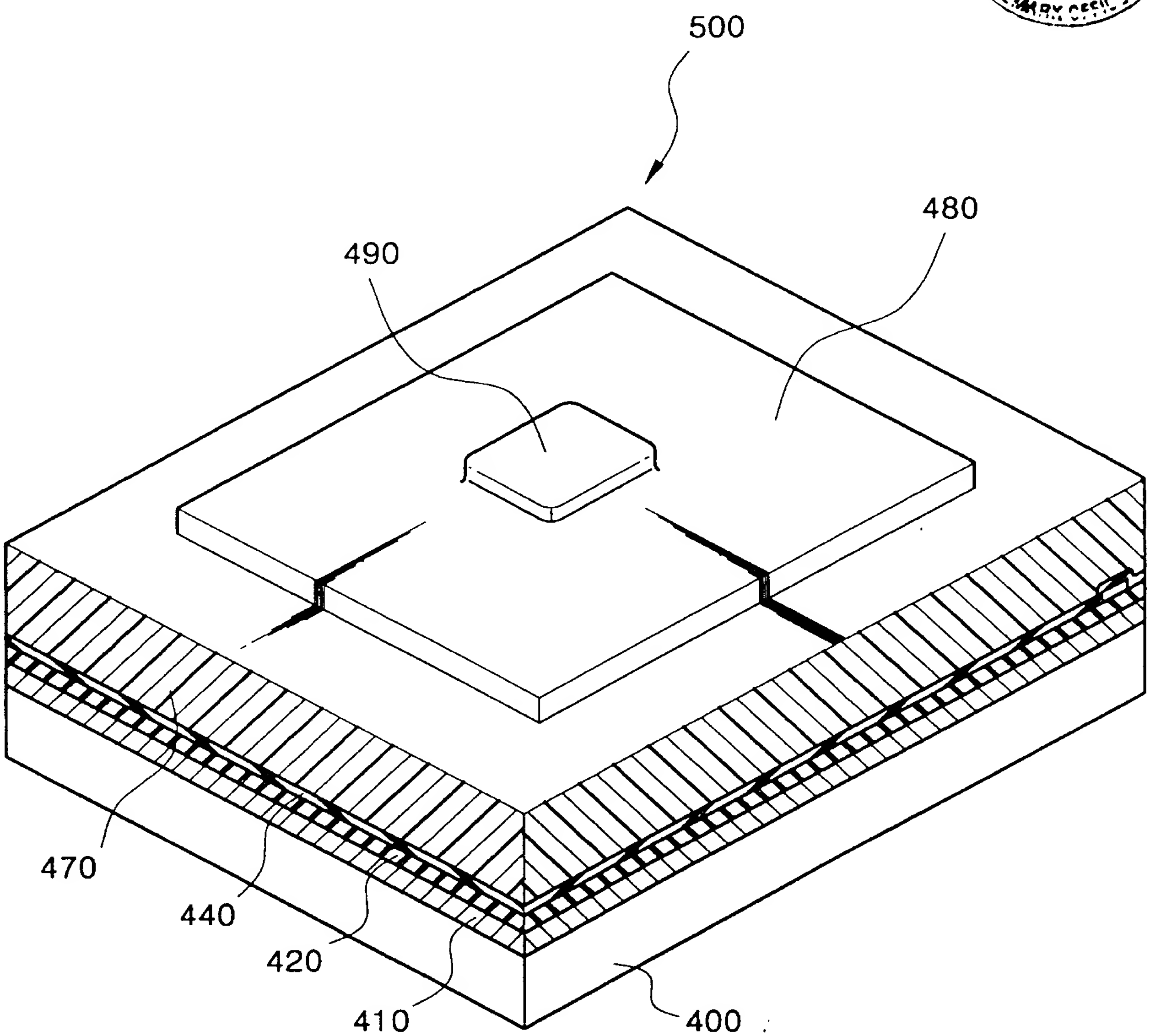


FIG.22.

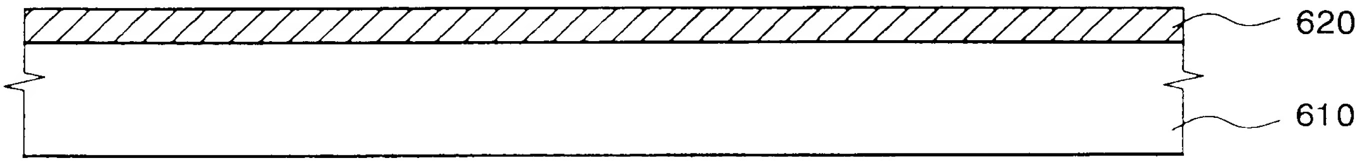


FIG.23

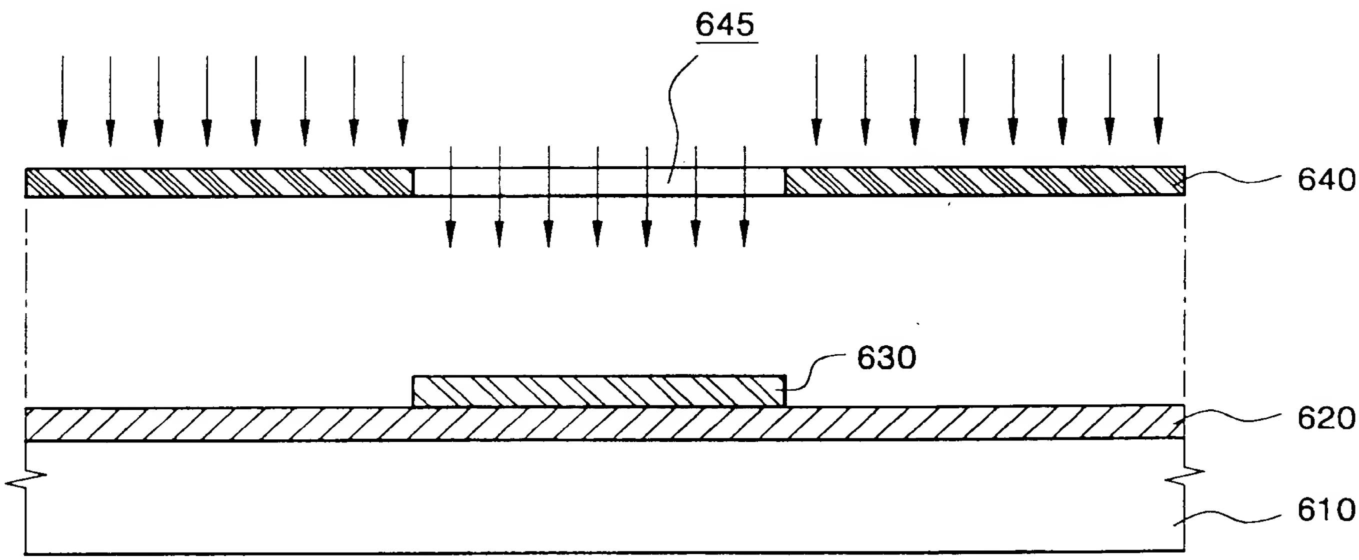


FIG.24

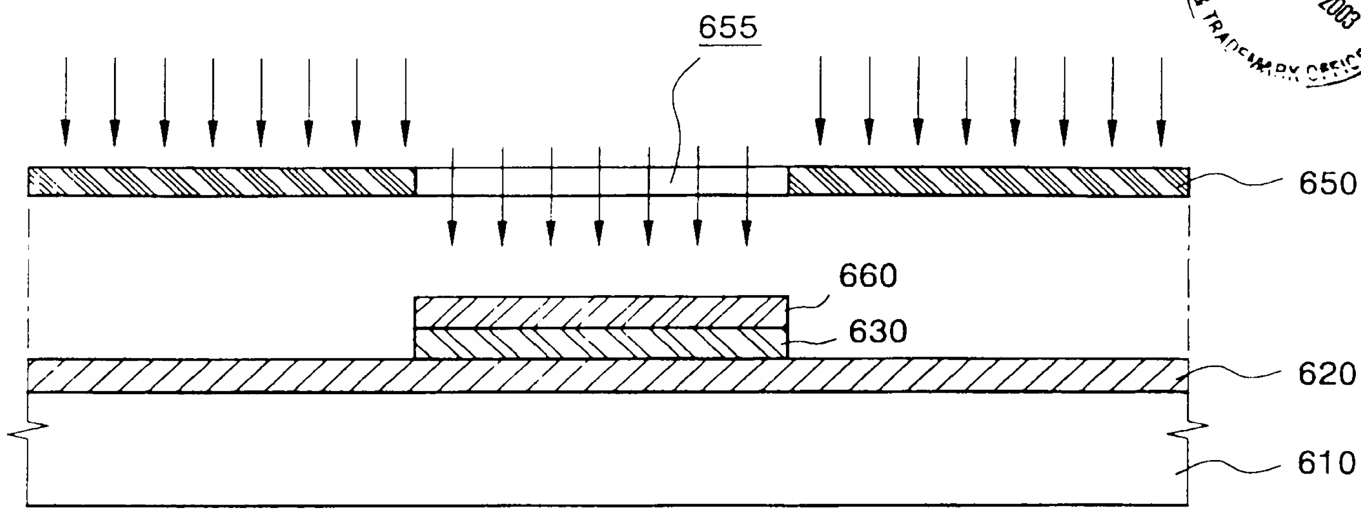


FIG.25

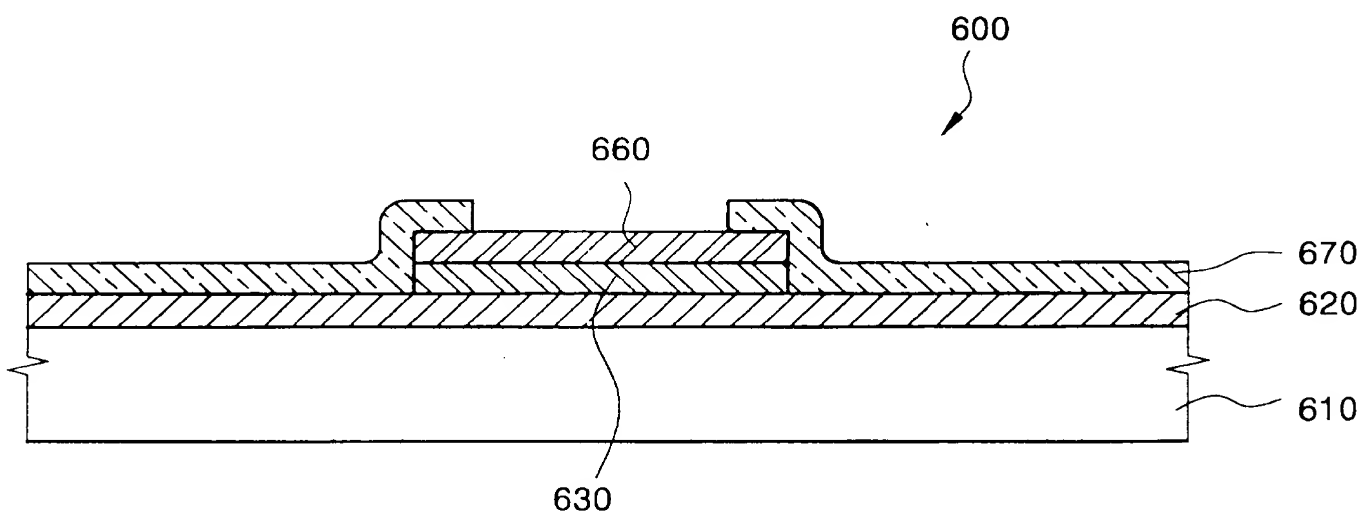


FIG. 26

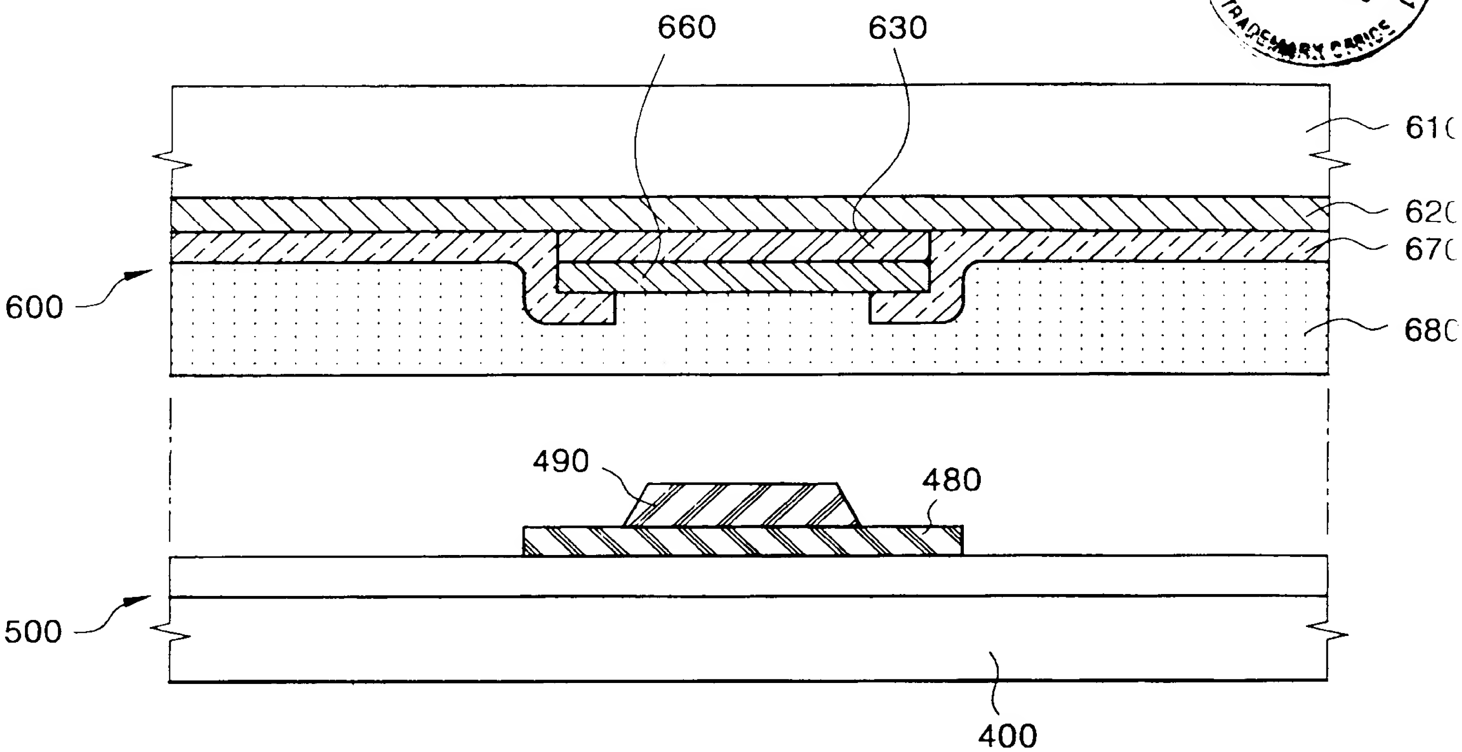

660
630
610
620
670
600
680
490
480
500
400

FIG. 27

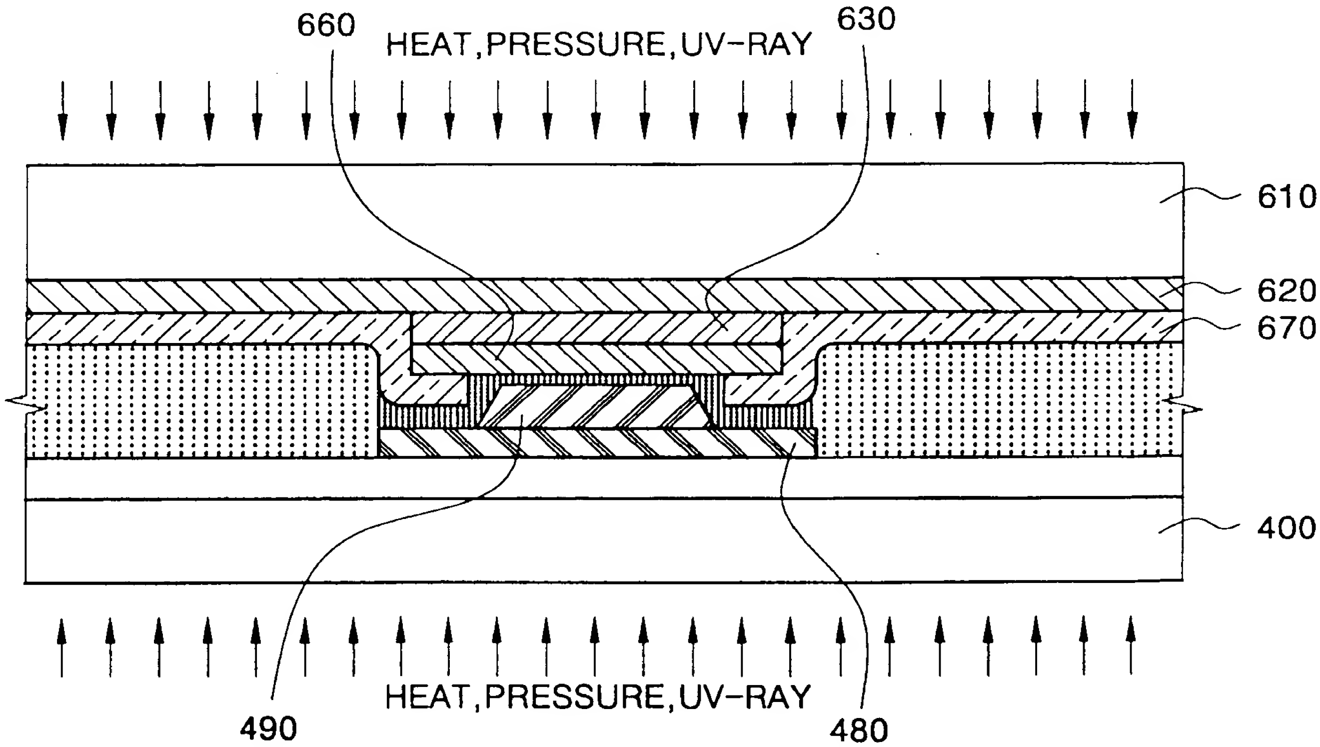

660
HEAT, PRESSURE, UV-RAY
630
610
620
670
400
HEAT, PRESSURE, UV-RAY
490
480

FIG.28

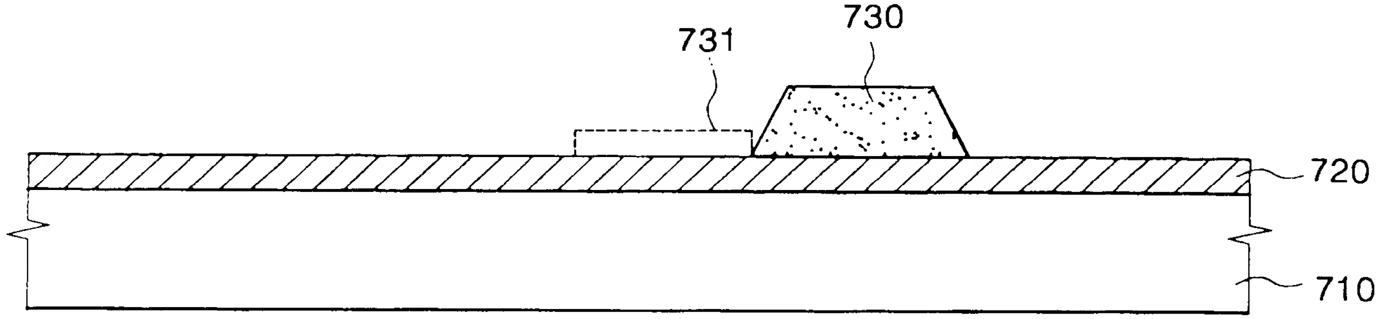


FIG.29

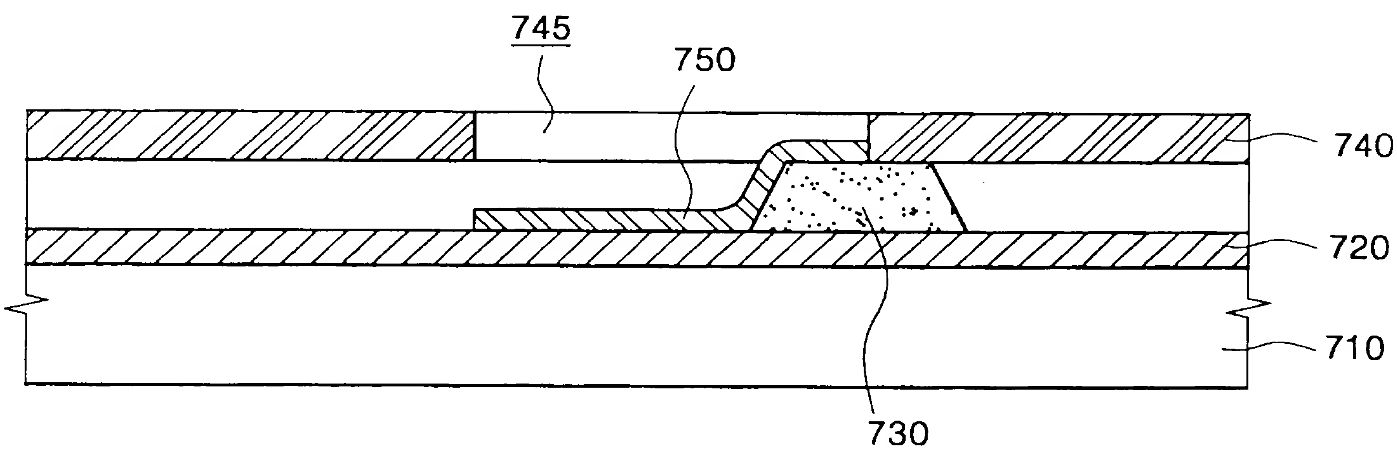
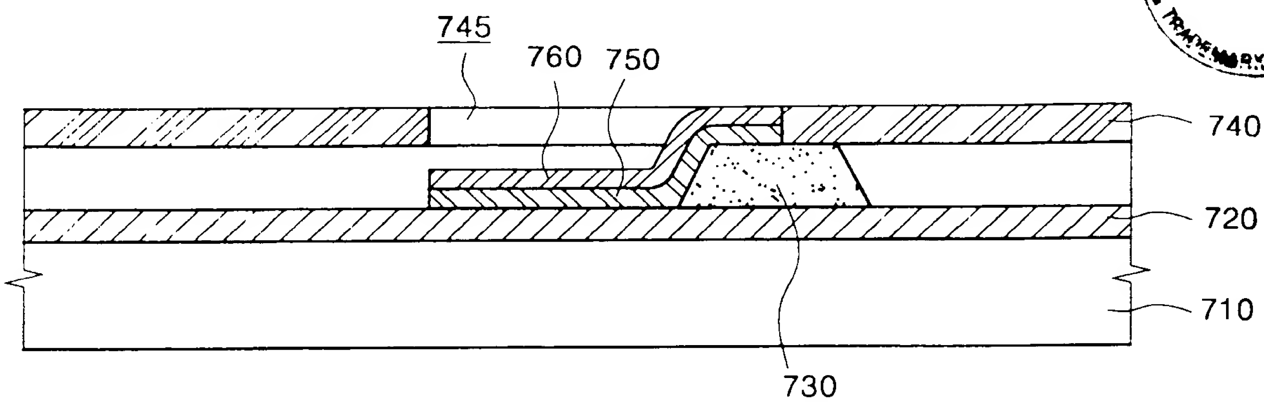
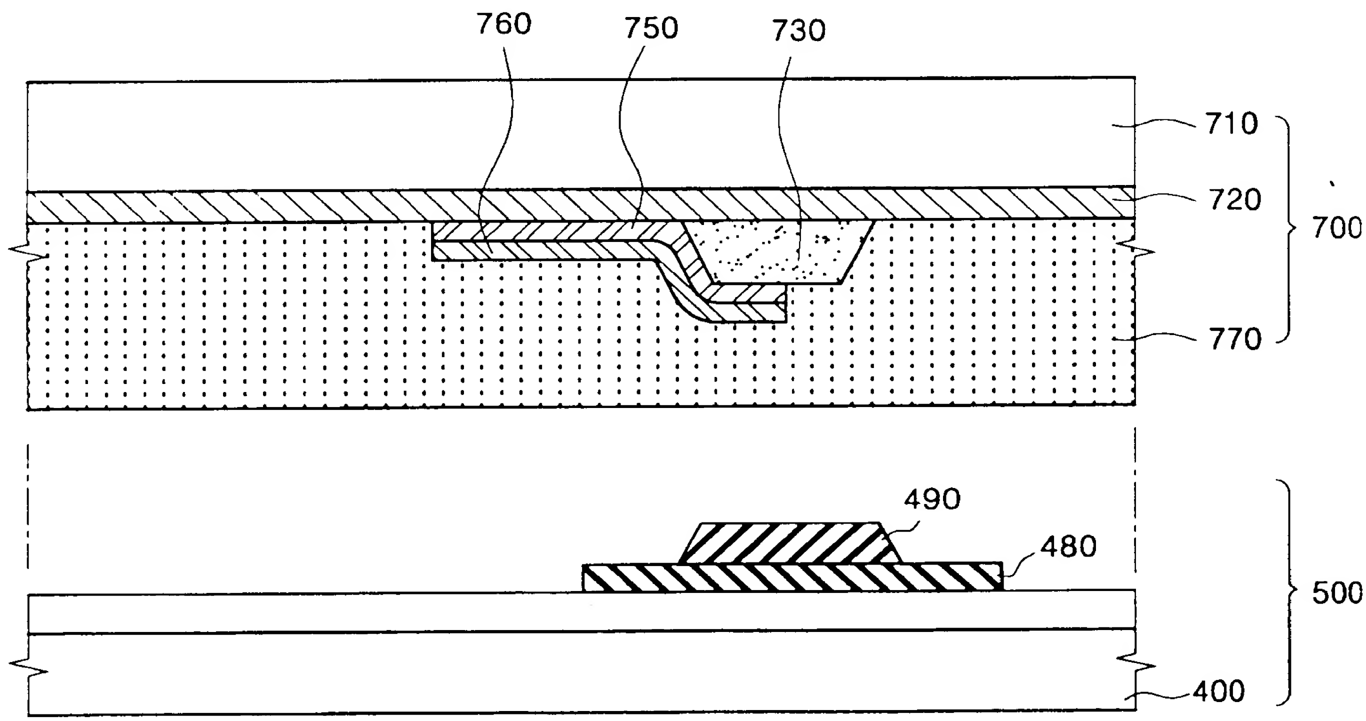


FIG.30



745
760
750
740
720
710
730

FIG.31



760
750
730
710
720
700
770
490
480
500
400

FIG.32